US Army Corps
of Engineers
Construction Engineering
Research Laboratories

USACERL Technical Report FF-95/07
March 1995

Determining an Army Installation's Critical Requirements (CORE)

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To better deal with these changes, facilities' quality, functionality, and criticality to mission must replace the traditional concept of sheer quantity of facilities and services. Installations will be smaller and will contain only those facilities that are unique to the military. Partnerships between military installations and local communities will provide the needs common to both: utilities, waste treatment plants, transportation networks, churches, libraries, schools, and housing. This study describes methods to determine the critical requirements (CORE) of Army installations, in both facilities and services, to determine those requirements that can be purchased from or shared with local communities.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave Blank)*

2. REPORT DATE
March 1995

3. REPORT TYPE AND DATES COVERED
Final

4. TITLE AND SUBTITLE
Determining an Army Installation's Critical Requirements (CORE)

5. FUNDING NUMBERS
4A162784
AT41
AZ4

6. AUTHOR(S)
Prameela V. Reddy, Joyce Baird, Samuel Ariaratnam, Victoria McCleary, Benedictus Mahi, Yoon Ho Lim, Robert Neathammer, Milorad Sucur, and Ellen Piety

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Construction Engineering Research Laboratories (USACERL)
P.O. Box 9005
Champaign, IL 61826-9005

8. PERFORMING ORGANIZATION REPORT NUMBER
FF-95/07

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of the Assistant Chief of Staff for Installation Management (ACS[IM])
ATTN: DAIM-FDP-P
600 Army Pentagon
Washington, D.C. 20310-0600

U.S. Army Center for Public Works
ATTN: CECPW-FM-A
7701 Telegraph Road
Alexandria, VA 22310-3862

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Copies are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

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To better deal with these changes, facilities quality, functionality, and criticality to mission must replace the traditional concept of sheer quantity of facilities and services. Installations will be smaller and will contain only those facilities that are unique to the military. Partnerships between military installations and local communities will provide the needs common to both: utilities, waste treatment plants, transportation networks, churches, libraries, schools, and housing. This study describes methods to determine the critical requirements (CORE) of Army installations, in both facilities and services, to determine those requirements that can be purchased from or shared with local communities.

14. SUBJECT TERMS
Critical Requirements (CORE)
Army Installation Master Plan
decision support systems

15. NUMBER OF PAGES
88

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	SAR

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std 239-18
298-102

Foreword

This study was conducted for Office of the Assistant Chief of Staff for Installation Management (ACS[IM]) under Project 4A162784AT41, "Military Facilities Engineering Technology"; Work Unit AZ4, "Real Property Planning, Acquisition, and Disposal (RPPAD)." The technical monitors were Gregory Brewer, DAIM-FDP-P and Gay Tissaw, CECPW-FM-A

The work was performed by the Facility Management Division (FF) of the Infrastructure Laboratory (FL), U.S. Army Construction Engineering Research Laboratories (USACERL). Michael Golish is Acting Chief, CECER-FF, and Alan Moore is Acting Chief, CECER-FL. The USACERL technical editor was William J. Wolfe, Information Management Office.

LTC David J. Rehbein is Commander and Acting Director of USACERL, and Dr. Michael J. O'Connor is Technical Director.

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1 Introduction

Background

The U.S. Army and the mission it performs are changing dramatically in response to internal and external pressures. Traditionally, the Army has required a heavy investment in Military Real Property Inventory, in a broadly-based installation infrastructure that presently includes millions of square feet of land and facilities.* Much of this aging infrastructure is becoming functionally obsolete and the resulting Maintenance and Repair (M&R) backlog has grow yearly and worsened in a climate of decreased funding and personnel resources. The Army's mission has also changed, from one of maintaining a strong, globally-deployed deterrent force prepared to fight a prolonged conflict, to one of supporting a smaller, highly mobile force, capable of meeting the challenges of short-duration conflicts and humanitarian assignments.

These circumstances have combined to force a re-evaluation of the traditional idea of how the Army operates and how it manages its installations. The soldier of the 21st Century will be trained and equipped to use costly and sophisticated weaponry that relies on state-of-the-art computer technology. Much of the training once conducted in the field will be done through computer simulation, which offers more suitable training in the use of high-tech weaponry, at significant cost savings over field-based training. Computer simulation can help save millions of dollars otherwise needed to develop weapons for training, to purchase large tracts of land for training in the use of long-range projectile weapons, and to prevent or restore training-related damage to the environment.

The concept of the future Army installation must support the notion of the 21st-century soldier. Facilities' quality, functionality, and criticality to mission must replace the traditional concept of sheer quantity of facilities and services. Installations will be smaller and will contain only those facilities that are unique to the military. Partnerships between military installations and local communities will provide the needs common to both: utilities, waste treatment plants, transportation networks, churches, libraries, schools, and housing. To achieve this goal, facility managers must identify the critical requirements (the "CORE") of an Army installation, in both

* 1 sq ft = 0.093 m^2

facilities and services, to determine which requirements can be purchased from or shared with local communities.

Objective

The overall objective of this study is to outline methods to determine the critical requirements ("CORE") of an installation. Critical requirements include both facilities and services, whether the facilities and services are actually on the installation or are purchased from or shared with a local community.

Approach

Classifications and categories of installations were studied to determine if a single "CORE" (critical requirements) could be applied to all installations (Chapter 2). City and Army long-range planning methods were evaluated and compared to identify similarities and differences in critical requirements of the two community types (Chapter 3). The analytical process for determining requirements for Army installations in general was explored (Chapter 4). The requirements for utilities and services were studied (Chapter 5). Installation Commanders were surveyed, and the Headquarters Real Property Planning and Analysis System (HQRPLANS) was examined to estimate the value placed on certain facility types and services, and to discuss the policy on requirements analysis (Chapter 6). Decision theory and decision-support models were developed to help managers determine the critical requirements of specific Army installations in a way that will support the Army of the 21st century in terms of mission-readiness and cost-effectiveness (Chapter 7).

Mode of Technology Transfer

It is recommended that this report be included with Long-Range Planning and Master Planning Guidance at the Headquarters, Department of the Army (HQDA), Major Army Command (MACOM), and installation levels. The decision-support models discussed in this report will help managers determine critical requirements for base support. Therefore, these decision-support models and methods are recommended for consideration in developing future computer systems for installation support and for decision support at HQDA.

2 Army Installation

Definition of Army Installation

In its most primitive form, an Army installation is any Army site with accountable real property. Its location may range from within a city boundary to a remote site. More specifically, an installation is an aggregation of contiguous or near contiguous common mission-supporting real property under the control of the Department of Defense or a State, the District of Columbia, territory, commonwealth, or possession, controlled by and at which an Army unit or activity is permanently assigned.

Categorization of Army Installations

Army installations may be classified as Major, Minor, Station, and Property. A Major installation has 5000 or more U.S. service members and/or U.S. Department of Defense (DOD) civilian employees assigned as reported in the Army Stationing and Installation Plan (ASIP). An installation not classified as Major and having 1000 or more U.S. service members and/or U.S. DOD employees or 300 or more U.S. DOD civilian employees as assigned in the ASIP, is classified as a Minor installation. A Station is any Army installation not classified as Major or Minor, and which has 100 or more U.S. service members and/or U.S. DOD civilian employees assigned as reported in the ASIP. Property is any Army installation with fewer than 100 U.S. service members and/or U.S. DOD civilian employees assigned as reported in the ASIP.

Army installations may be categorized as:

- **Command and Control Installations**—MACOM Headquarters
- **Fighting installations**—maneuver and major training areas
- **Training installations**—initial entry training and branch or professional schools

- **Industrial Installations**—depots, commodity-oriented and production installations and ports, and Reserve Component Installations
- **Other**—Corps of Engineers Divisions and Districts, Hospitals, Communications, and miscellaneous.

Objectives of Army Installations

Specific objectives of installations are to support the tenants in accomplishing their missions by providing needed facilities and services.

Carrying Capacity of an Army Installation

The carrying capacity of an installation is defined as its capacity to provide suitable facilities, access, utilities, safety, and security to support missions. Carrying capacity of an installation includes Army assets on-post as well as other nearby DOD assets and off-post availability of facilities and services.

Common Requirements for All Army installations

Before analyzing if there is a single "CORE," or group of critical requirements for all Army installations, it is necessary to study the missions of the installations. Army installations are not homogeneous; each has a unique mission. The facilities and services requirements of the installations are based on the specific missions they must perform. For example, a "training area" is a critical requirement for a fighting installation, but not to other types of installations. Common facilities to all installations are land, utilities, housing, administration, communication, and some storage facilities, but the magnitude of the requirement for these facilities depends on the specific functions they are required to perform. For this reason, a single core is not applicable to all Army installations. The facilities and services requirements and their criticality are based on the missions the installations are required to perform.

3 Long-Range Planning

The Planning Concept

Planning and plans are common to both business and government. The term "planning" commonly conveys the idea of preparing for the future. Governments go to great lengths to develop long-range plans to help develop their nation's future. These long-range plans are intended to provide guidelines, design criteria, and policy statements expressing a community's development intent. A long-range plan sets forth the general framework or structure of development. These elements include: street and highway networks; utility systems; the area, location, and relationship of major land uses; the densities of development; and the quality of the built environment. This chapter analyzes the components of a long-range plan and the planning process for both civilian cities and Army installations. Although the processes for each are different, their intent and basic content are strikingly similar.

City Comprehensive Plans

City general plans are referred to by several names: city plan, development plan, master plan, growth management plan, comprehensive plan, etc. The name differences often reflect the plan's intent. For convenience, this chapter will refer to a city general plan as a *comprehensive plan.*

Despite differences in name, these plans all have a number of common elements:

1. Comprehensive plans are an expression of community wants, including community goals, objectives to obtain these goals, and a vision of the community's future.
2. Comprehensive plans have a long-range quality. Usually a comprehensive plan is developed as a 20-year plan, updated approximately every 5 years. A comprehensive plan is largely a snapshot of what a community will look like in 20 years. A comprehensive plan expresses current policies to help shape a desired future condition and how the community will arrive at that condition.
3. Comprehensive plans cover a city's entire geographic area and address all required elements. They encompass all the functions that make a community

work such as utility systems, transportation, land uses, public services, housing, employment, and recreation. Moreover, comprehensive plans consider the interrelationships of these functions.

4. Comprehensive plans are statements of policy that cover such community desires as character, location, and rate of growth (be it no growth, slow growth, rapid growth, or decline) and also indicate how these desires will be achieved.
5. Comprehensive plans are decisionmaking guides that provide a way to influence the many public and private decisions that create a community's future.

A city's comprehensive plan has no set format and typically varies from city to city. However, every comprehensive plan usually contains, but is not limited to, certain components (Table 1). Each component usually consists of three parts: (1) a description of existing conditions; (2) a statement of goals and objectives; and (3) a description of future needs and proposals for meeting them. At the most general level of planning, the planning process for a city is divided into five major steps:

1. **Determine the basic goals for the community.** How much does the community wish to grow? What kind of economic growth can be accomplished, e.g., in the development of new shopping centers or industrial parks? What kind of balance should be invested in highways and mass transit? These types of questions, usually determined by both public officials and the public through public involvement, help to shape the goals of the plan.
2. **Planners study and analysis,** among other things, land use, population trends, economic base of the community, and the physical geography of the community.
3. **Prepare a plan and a policy** for a segment for a segment of, or the whole the community. This basic statement outlines how the community will develop, in what direction, and perhaps in how many phases.

Table 1. Components of a city comprehensive plan.

Components	Description
Demographic conditions	Outlines existing and expected population and employment composition of the community
Land Use	Describes current and projected land use within the community and adjacent unincorporated areas
Utilities	Outlines proposals for maintaining or improving the utility systems within the community which may include storm and sanitary sewer systems, water, and electricity
Community facilities	Treats the capital plant of the community and includes schools, parks, libraries, and other public buildings such as city hall, museums, and the like
Transportation	Outlines proposals for adding to or improving the street and highway systems and mass transit system and may contain proposals for other aspects of the transportation systems including: bicycles, pedestrians, airports, and harbors

4. **Adopt and implement the plan.** Planners must sometimes create zoning ordinances, land subdivision regulations, general guidelines for private development and public investment, etc.
5. **Monitor progress and get feedback** to determine how well the plans and policies are being carried out. This step shows if the original goals were realistic and whether the study and analysis performed correctly foresaw the changes within the community. Feedback is the basis for redesign of the plan as new, unforeseen occurrences take place within the community.

Figure 1 shows this process in more detail.

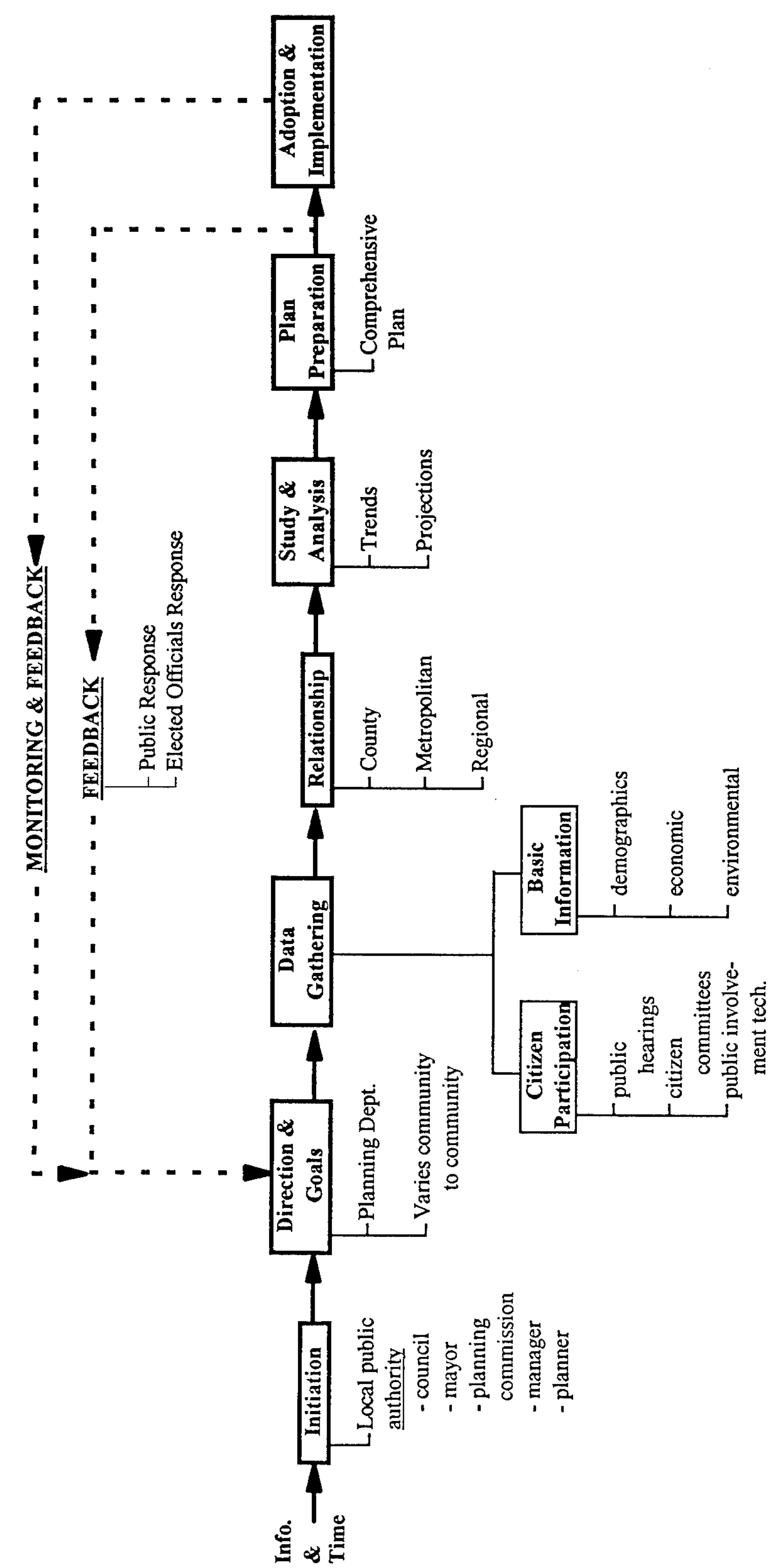
Army Master Plans

Army long-range plans for installations are referred to as master plans. Master plans serve as a guide to enable decisionmakers to better support the military mission and to better meet goals and objectives of the installation. As stated in the *Army Installation Master Planning* course (p 3-2), Army comprehensive planning should:

> . . . lead to development and facilities management proposals that best meet the command goals and mission objectives established by this process and most appropriately consider the installation's special opportunities and constraints. Comprehensive planning goes beyond the placing of buildings or maintaining existing condition maps; it includes all facilities programs and resources that aid installation management and development. All areas and activities affecting or affected by installation development and operations are covered. Included in Army comprehensive planning are operational and physical, energy, social, aesthetic, economic, and ecological factors. Additionally, this process incorporates traditional physical master planning, natural resources planning, and environmental protection and historic preservation planning.

An Army installation master plan is a beneficial guide in that it is used in the review and action of the following areas (*Army Installation Master Planning*, p 2-4):

1. Proposed land acquisitions, changes in land use, site, and building plans for individual construction and development projects on an installation
2. Proposed disposition of land
3. Direction for the future short and long-range development of the Army community and installation
4. A framework for a number of interrelated plans, which contribute to the master plan. These plans are called "contributing plans."



Source: *The Practice of Local Government Planning,* pp 82-89.

Figure 1. City long-range planning process.

5. A way to show the interdependent relationship between the parts of the master plan and the contributing plans
6. The mechanism to relate the installation mission to plans for facilities, programs, projects, and policies required within installation boundaries to support the Army community that resides or works on the installation
7. The mechanism to relate the needs of the Army community to the social, cultural, and economic infrastructure of the surrounding civilian community and region
8. The framework for preparing the 5-year plan, and other construction programs and major renovation and replacement programs.

An Army Installation Master Plan is comprised of a series of interrelated documents (Table 2).

The *Army Installation Master Planning,* Control #075 course book states that at the most general level of planning, the planning process for an Army installation is divided into four basic steps:

1. **Reconfirm requirements.** This step involves gathering documents on existing conditions. This may include installation mission, existing master plan documents, approved 5-year program, and the Building Information Schedule or the IFS Real Property Report. Included in this step is also the formulation of goals and objectives.
2. **Collect and evaluate data.** This step involves collecting current information on the installation both off-post and on-post, in the immediate region and general vicinity, and evaluating the information for specific needs or constraints to the installation operation and mission. A summary of limitations results from the data evaluation, which is used in later requirements analysis.

Table 2. Components of an Army master plan.

Components	Description
Basic information documents	Provides accurate and current information about the layout and physical conditions of the installation. These documents consist of Building Information and Existing Condition Maps.
Master Plan Report (MPR)	A written record of existing operational and environmental conditions at the installation and the planning rationale used to determine the installation's long-range goals and objectives.
Tabulation of existing and required facilities (TAB)	Is an inventory of existing and long-range facility requirements corresponding to the installation's mission.
Future development plans	Maps that graphically portray the installation's peacetime development. These maps include the following, but are not limited to: regional area, installation land use, building area land use, general site plan, tree cover, and roads and railroads.
Project phasing plan	Depicts the installation's 5-year construction program in relation to an overall future facilities' site plan.

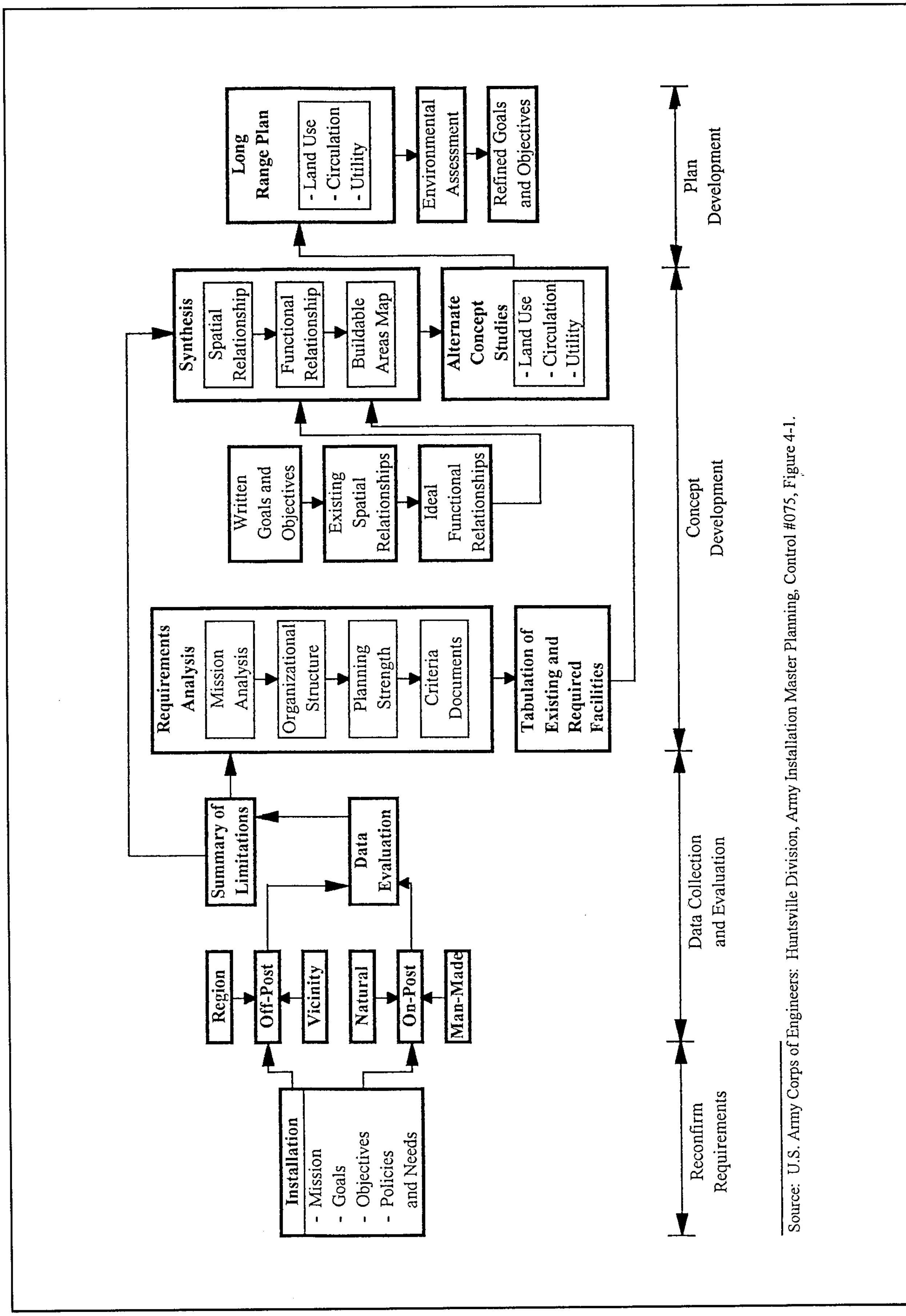
3. **Develop concepts for requirements analysis, existing spatial relationships analysis, and develop ideal functional relationship diagrams.** A synthesis process will help develop various alternative concept studies consisting of a land use element, circulation element, and utility service element.
4. **Develop a plan.** Select a preferred concept study from the alternate studies and develop the Long-Range Plan for the installation. Further refinement of the installation planning goals and objectives may also occur at this step. Figure 2 shows this entire process.

City and Army Long-Range Planning Comparison

City governments and the Army both use long-range planning to guide and shape future development of communities and installations. A city uses the plan to support and express community desires for change and growth while the Army uses the plan to support a military mission. While one is developed in conjunction with the public's input and opinion, the other is strictly handed down by a higher authority and developed according to set regulations. Even so, both are developed to determine present conditions, forecast future growth or decline, determine goals and objectives, and develop policies and plans that shape the community's or installation's future. Table 3 lists the principal differences between City and Army Long-Range Plans. Note that, while each expression of what each plan accomplishes is different, the basic ideas behind them are quite similar.

Figure 3 shows the planning processes for both city and Army. Both the city and Army processes consist of (1) data gathering, (2) analysis, (3) synthesis, and (4) feedback. The processes themselves are quite similar in that each involves obtaining information, analyzing that information, and developing a final plan. There is a constant feedback loop to the beginning of the cycle as conditions within the community or installation change over time.

The two processes differ in that the Army plan is developed under strict guidelines to support a specific mission while the city plan varies from community to community and can support a wide range of goals. In addition, the feedback for Army is from the commander or higher command; therefore, goals become "top loaded." The City, on the other hand, receives some feedback from elected officials, but mainly gets feedback from the public affected by the plan. Ideally, the goals within the city plan are established by the whole community. To get a better understanding of city planning procedures, researchers visited representatives from the planning departments of the City of Champaign and the Village of Rantoul (Appendixes A and B).



Source: U.S. Army Corps of Engineers: Huntsville Division, Army Installation Master Planning, Control #075, Figure 4-1.

Figure 2. Army long-range planning process.

Table 3. City and Army long-range plans.

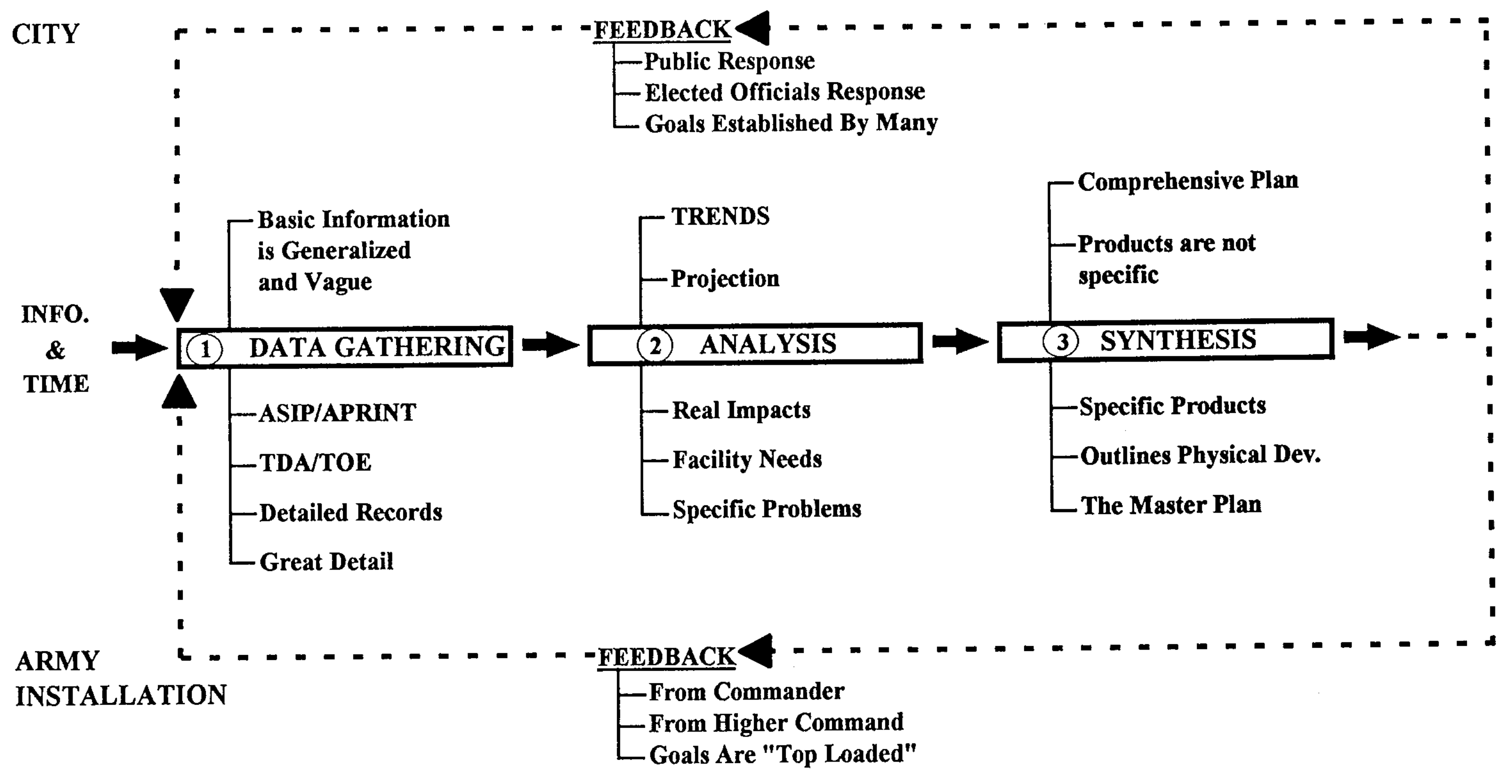
City Comprehensive Plan	Army Master Plan
Is an expression of what a community wants: a statement of goals, a listing of objectives, and a vision of what might be	Is an expression of what the Army wants: a listing of objectives for the installation in support of the military mission, and a vision of what might be
Serves as a guide to decisionmaking by providing the means for guiding and influencing the many public and private decisions that create the future of the community	Serves as a guide for planning and managing an installation to meet the command goals and mission objectives considering the installation's special opportunities and constraints
Represents a future plan for the community to meet the needs of the community; may represent the fulfillment of a legal requirement, safety requirement, or security requirement	Represents a future plan for the installation to meet the requirements of the missions, personnel, and equipment; may represent the fulfillment of a legal requirement, safety requirement, or security requirement

It is difficult to determine the benefits and drawbacks of each process since each strives to serve a different purpose, one to meet a military mission and the other a community's wants and needs. It is clear, however, that the basic steps throughout the two processes are quite similar. Although the Army process needs to follow strict regulations, there may be something to learn from the City process in that each community has different needs, just as each installation will have different parameters inhibiting or enhancing its ability to meet its mission. Long-Range Plans must therefore reflect these differences and vary in their purposes and goals. The Army also does this by varying Master Plans to reflect installations' differences.

Critical Requirements and Comprehensive Planning

Comprehensive planning is a continuous analytical process that involves evaluating factors affecting the present and future physical development of an installation. This evaluation forms the basis for determining objectives to solve current problems and meet future needs to effectively support missions, management processes, and community aspirations. The next step of the process is to determine the facilities and services required to support the objectives. Requirements analysis is a major part of the Army installation master planning process.

The requirements in the master plan documentation include facilities and services requirements that support an overall environment of quality for the force and provide the power projection platforms necessary for national security. The requirements and their importance to support the objectives of the installation vary based on the needs and their criticality. Determining critical requirements necessarily implies a method to rank requirements. Certain special studies and a computer model are needed to develop this prioritized list of requirements. The model and the methodology are discussed in more detail in Chapter 7, "Decision-Support Methods/Models" (p 40).



Source: *US Army Corps of Engineers: Huntsville Division, Army Installation Master Planning, Control #075, Figure 4-2.*

Figure 3. Comparison of community and Army planning processes.

4 Army Installation Requirements

Estimating Requirements

The ASIP available for CONUS planning is a report provided on a semiannual basis to MACOMs and installations. The ASIP provides installation populations for all CONUS Army installations. These numbers are used by the installations, MACOMs, and the HQDA staff to determine the facilities and services requirements. An installation master plan focuses on defining facilities and services requirements and sets a direction and strategy to meet those needs. Adequately defining these requirements is the key to satisfying facility needs for mission accomplishment. The Real Property Master Plan (RPMP) is developed and maintained to ensure efficient space management, acquisition, accountability, and disposal of real property at Army installations. This plan establishes the installation commander's vision and future direction of the installation's land, facilities, and infrastructure.

The required number and sizing of facilities depend on the respective facility type. The Army Criteria Tracking System (ACTS) is an automated information database that provides a single information source for Army facilities authorization criteria. Each installation has an organizational structure reflecting its mission. Tables of Organization and Equipment (TOE) establish the organizational structure, personnel, and equipment of Army units. Tables of Distribution and Allowances (TDA) prescribe the organization and equipment for special purpose temporary units. An installation's size, strength, and complexity are determined by the TOE and TDA units assigned to that installation. Land, facilities, and services requirements are based on the units assigned to that installation, authorization criteria, and available existing facilities. Current facilities must be fully utilized before additional facilities can be programmed. Plans and programs are developed in harmony with environmental, energy, safety, and security requirements.

Army Units and Their Land Requirements

Population units within the Army are well defined, as are space requirements:

- Squad—comprised of approximately 10 individuals and is the basic infantry unit, usually commanded by a Staff Sergeant.

- Platoon—Comprised of three to four Squads and is the primary infantry maneuver element for unit training, usually commanded by a Lieutenant.

- Company—Comprised of three to four Platoons and usually commanded by a Captain.

- Battalion—Comprised of three or more Companies and the lowest unit to be provided with an administrative staff, usually commanded by a Lieutenant Colonel. A battalion requires buildable land area for the battalion headquarter, classroom, storage, company administration and supply, unaccompanied troop housing, and dining and troop recreation facilities. Land required for the assigned units is: for a large battalion: 23 acres; medium battalion: 17 acres.* The maintenance area is organized into blocks by battalion and is located within walking distance of the brigade area, for a large battalion, 13 to 14 acres; medium battalion, 17 acres.

- Brigade—Comprised of three to five Battalions and usually commanded by a Colonel. A brigade requires buildable land area for the housing and support facilities of three to five battalions. This would consist of the brigade headquarters and administration, unaccompanied troop housing, dining, troop recreation and support facilities that are required for the assigned units in the brigade (approximately 110 to 135 acres).

- Division—Comprised of three combat Brigades, three combat support Brigades, and one Brigade-sized element composed of the remaining assigned units. The Division commander is a Major General. The Division is the basic maneuver element in the Corps. A division requires buildable land area for the housing and support facilities of seven brigades (approximately 1120 to 1450 acres). The buildable land needed depends on the structure of the force that will use the installation.

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* 1 acre = 0.4047 hectare.

- Corps—Comprised of two to five Divisions and is the largest size TOE organization for which Army installations are planned. The Corps commander is a Lieutenant General.

Facilities Requirements

Several sources of facilities planning guidance provide the broad and sometimes specific direction for developing facilities requirements and the facilities plan. The Army Long-Range Planning Guidance (ALRPG) provides a set of broad, 30-year goals. The Army Plan (TAP) covers a 15-year period and provides facilities goals for mid-range and long-range facilities planning. The Army Guidance (AG) provides 15-year and 5-year objectives and is used for the development of the 6-year program. Program Objective Memorandum (POM), ASIP, and Unconstrained Requirements Report (URR) are some other documents on which facilities requirements, and short- and long-range plans to meet these requirements are based.

The Real Property Planning and Analysis System (RPLANS) and the HQRPLANS are installation and HQ-level automated master planning tools to provide the capability to calculate facility allowances based on ASIP strengths and authorized space planning criteria, and to compare them with existing real property facility asset data to list the excesses and deficiencies of a wide range of facility types. Where facility allowance criteria do not exist, facilities requirements are based on accepted industry practices and user requirements, and are fully justified by the user.

Identification of all facilities requirements (construction, maintenance and repair, conversion, lease, etc.) and development of a plan to meet these requirements are the four components of RPMP:

1. Long-Range Component (LRC)
2. Capital Investment Strategy (CIS)
3. Short-Range Component (SRC)
4. Mobilization Component (MC).

The LRC establishes the basic framework for developing and managing the installation. Installations develop their LRC of RPMP based on guidance from MACOM and DA. This guidance is based on TAP, ALRPG, and AG. The facilities requirements analysis and planning process for LRC analyzes the existing facilities and their condition, the capacity of the installation, the constraints, on-post and off-post opportunities, threats, and trends in relation to the guidance from the top to develop a facilities requirement plan for LRC of RPMP.

The CIS is the installation commander's overall plan for investing in real property to support installation missions and objectives of the Army Long Range Facilities Plan (ALRFP). The CIS provides the basis for programming projects in the SRC. It summarizes the requirements analyses and forms the commander's investment strategy.

The SRC integrates real property master planning into the Army's operational planning process. It implements the CIS by identifying specific projects for real property management and development, and reflects the installation commander's plans to allocate resources to facility construction, revitalization, major repair, and major environmental undertakings. It identifies specific programming actions and funding streams to implement the CIS over the 6-year POM period. All facility resource requirements must be identified and integrated into the master plan.

The MC supports the mobilization planning strategy of the installation. It develops the expansion capability analyses of the LRC into specific plans to allocate existing facilities and acquire needed additional facilities to support mobilization missions, functions, and tasks.

Developing valid facilities requirements is a complicated process requiring close cooperation among staff elements at HQDA, MACOMs, and installations. The prioritization of these facilities requirements determines the future infrastructure for the Army. It therefore requires sound judgement in allocating resources to achieve the best mix for constructing, operating, and maintaining the facilities.

Services Requirements

Services requirements can be generally viewed as two major types: (1) community service requirements, and (2) utility service requirements. Community service requirements include educational, health, religious, cultural, recreational, safety, security, retail, and other supporting requirements such as communications, fire, water, etc. Utility service requirements include power, water, sanitary sewage treatment, fuel requirements, etc. On Army installations, most of the community facilities requirements such as chapels, dependent schools, gymnasiums, laundries, etc. are determined by tabulation of existing and required facilities (TAB) based on Army criteria (Table 4).

Some of the community service requirements of an Army installation may be met by off-post facilities, eliminating the need for on-post construction. If the installation is in an urban area, most of the community facilities will be available in the urban area.

Table 4. Space criteria for family and community support/service centers.

Military Populations[1]	Gross Area[2] Square Feet	Gross Area[2] Square Meters
Up to 1,000	Footnote[3]	Footnote[3]
1,001 - 3,500	4,500	418
3,501 - 7,000	6,500	604
7,001 - 10,000	8,000	743
10,001 - 15,000	9,500	883
15,001 and over	11,000	1,022

1 Military population is defined as active duty military personnel assigned to an installation, plus 25% of their dependents. An additional 900 SF gross area may be provided for a classroom at installations when the installation exceeds 7,000 personnel.
2 Mechanical equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.
3 This requirement should be accommodated in other facilities.

If those services are economical to use among the available alternatives, an installation may prefer using them to get a better mix of allocation of resources. Off-post data collection and analysis are needed to identify regional conditions regarding the availability of community facilities, major transportation facilities, and access points into the installation.

The evaluation of community services should consider the location of hospitals and other medical facilities available in the local area, any agreements for the provision of primary or emergency police or fire protection to the installation, the location of elementary or high schools, recreation facilities, and other community support facilities providing support to the installation. If an installation has excess capacity on-post, it may consider agreements to provide services to an adjacent area. All this analysis will be translated into required community service facilities.

A complex network of utilities services including electric power, water, communications, sanitary sewage, and fuel supply are required to support the land use arrangement, missions, and community. The following steps should be taken:

1. Analyze the capacity of existing utility services to meet future missions, facilities, and community needs. (Installation growth depends on the adequacy of the utility systems to meet increased demand, safety, and environmental constraints.)
2. Evaluate the capacity of each system to support the land use pattern in LRC.
3. Identify utility service requirements for each facility/function and establish the carrying capacity of each major component of the system.
4. Examine the present distribution system relative to future missions.

5. Determine the magnitude of improvement necessary to remove any limitations.
6. Determine the strategy by identifying the source, and alternative ways of meeting the limitations. (Off-post suppliers may provide some of the utility services.)

Other services such as roads, railways, street lighting, solid waste disposal, and drainage have to be coordinated with the overall plan, and all requirements need to be identified. Environmental protection, safety, and security requirements will be identified and all considerations will be coordinated with RPMP. Productivity enhancement and energy efficiency requirements will also be identified.

Total requirements are the combination of all of the above requirements. They include construction, conversion, renovation, maintenance and repair, lease, and other agreements with off-post. They are the combination of sustainment requirements, improvement requirements, acquisition requirements, and disposal requirements.

5 Utilities and Services Requirements

Utilities and services requirements are important when determining the critical requirements for an Army installation. These elements are essential in the planning and engineering of installations to ensure that the mission is served. Utilities include: water, storm, and sanitary sewers; electrical services; and gas lines. Services requirements include: transportation access, fire safety, and security.

Planning these requirements is necessary to determine both capacity and alignment. Capacity planning is especially critical for utilities where usage may vary according to changing missions and political situations. For example, during the Gulf War in 1990, Fort Polk, LA served as a deployment center and temporarily housed approximately double its normal population. The utilities had adequate capacity for this influx of personnel since they normally operate at only 25 percent of total capacity. Overdesign of utility capacity is a requirement in public utility planning and design, and should always be an Army criterion due to uncertainty associated with changing missions and political situations. Alignment of utilities should be considered during the planning process because of its implications to potential downsizing and/or closure of installations. At one military installation studied, the utilities were aligned using the logic that "the closest distance between two points is a straight line." As a result, some underground utilities passed through land without easements. This caused problems in parceling sections of the installation for public sale after closure.

Utilities Requirements

Condition and capacity of utilities need to be considered in determining critical requirements. As with facilities, proper inspection enables preventive maintenance of utilities to save money that in the long run might otherwise be lost to deterioration and potential failure. Army engineers should ensure that these requirements, especially utilities, meet changing National codes. This is important during downsizing and/or closure where land parceled for public sale must adhere to National codes.

The Army has several manuals for utilities and services requirements planning, including: the COE Design Guide, AEI Manual, etc. These, combined with National codes, provide excellent guidance for utilities planning and can provide a basis for estimating utilities requirements and deficiencies.

Underground Utilities

Underground utilities include: water, storm, and sanitary sewers; electrical services; and gas lines. These should be planned to minimize present and future costs. The AEI Manual states that, "planning of utility lines should minimize easements, capital investments, and operating costs for maintenance and repair by considering items such as:

1. Utility easements or right-of-ways
2. Location, size, and elevations of existing sewers, etc.
3. Location, size, and elevations of existing water supply, gas and heat transmission mains, and underground electrical services."

The AEI Manual also states that, "underground distribution lines should be located so that a minimum cost and effort would be required for excavation when required for maintenance" and that "these should be located at the minimum depth necessary."

Water Lines Analysis

The CESG-02660 provides excellent guidance in planning and design of water lines. Several rules for installation of water lines are:

1. Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 ft from a sewer except where the bottom of the water pipe will be at least 12 in. above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 ft from the sewer.* Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 ft each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 ft horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 ft above the sewer main. Joints in the sewer main, closer horizontally than 3 ft to the crossing, shall be encased in concrete. (CE Design Guide, Paragraph 3.1.2.1)

* 1 ft = 0.305 m; 1 in. = 25.4 mm.

2. Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring. (CE Design Guide, Paragraph 3.1.2.2)
3. Copper tubing shall not be installed in the same trench with ferrous piping materials. (CE Design Guide, Paragraph 3.1.2.3)
4. Where nonferrous metallic pipe, e.g., copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 in. shall be maintained between pipes. (CE Design Guide, Paragraph 3.1.2.4)

One system currently used by the Army to analyze and plan water requirements is the "Installation Water Resources Analysis and Planning System (IWRAPS)." IWRAPS is a tool designed to help installations identify current water use and predict future needs. Using indirect measurements of water use, researchers developed a statistical correlation between square footage for each water use section in RPLANS and the per capita water use. IWRAPS helps installations estimate water use impacts related to mobilization, downsizing, and/or closure.

Approximate water line requirements may be calculated using *per capita* daily water requirements planning guides by type of occupancy. These *per capita* water requirements by building type can be used as a basis to estimate the installation water requirements and the capacity of existing water lines (excesses or deficiencies). The condition of these facilities should also be considered in determining requirements.

Sanitary Sewer System Analysis

The CESG-02730 provides excellent guidance in planning and design of sanitary sewers. Several rules for installation of sanitary sewers are provided:

1. "Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 10 ft to a water-supply main or service line, except that where the bottom of the water pipe will be at least 12 in. above the top of the sewer pipe, the horizontal spacing may be a minimum of 6 ft. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 10 ft on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 3 ft to the crossing. The thickness of the concrete encasement including that at the pipe joints, shall be not less than 4 in." (CE Design Guide, Paragraph 3.1.1.1)
2. "Where sewer pipe is to be installed within 3 ft of an existing or proposed building or structural foundation such as a retaining wall, control tower footing, water tank footing, or any similar structure, the sewer pipe shall be sleeved as

specified above. Care shall be exercised and proper precautions taken during installation of the sewer pipe and sleeve to assure that there will be no damage to such structures and no settlement or movement of foundations or footing." (CE Design Guide, Paragraph 3.1.1.3)

Approximate sanitary sewer system requirements may be calculated using *per capita* daily usage planning guides by type of occupancy. These *per capita* daily usage by building type can be used as a basis to estimate the sanitary sewer requirements and the capacity of the existing system (excesses or deficiencies). The condition and adequacy of these facilities should be considered in determining requirements.

Storm Sewer System Analysis

Often a storm drainage system is composed of a closed or piped system and natural drainage areas such as swales or streams that pick up the water from the closed system. Controlling storm water runoff to prevent problems caused by erosion or flooding is the goal of estimating storm sewer system requirements. Surface drainage can be provided by adjusting ground slopes to allow for runoff of storm water and its interception at various intervals in catch basins. The adequacy of a storm sewer system is based on the amount of rainfall to be carried away at a given time. Runoff is that portion of precipitation that finds its way into natural or artificial channels either as surface flow during the storm period or as subsurface flow after the storm has subsided.

The CESG-02720 provides excellent guidance in planning and design of storm sewers and contains similar directions for installation as contained in CESG-02730. The condition and adequacy of existing storm sewer system are analyzed to estimate the storm sewer system requirements.

Electrical Services Analysis

When planning the electrical services for an installation, it is important to estimate the total load for each facility to plan such spaces as transformer rooms, chases, and closets. An exact total load can be made only after completion of the final design; however, estimates may be made from using information gathered by the National Electrical Code (NEC) of the National Fire Protection Association (NFPA) (Table 5).

The condition and adequacy of existing electrical system are analyzed to estimate the electrical system requirements.

Table 5. Sample planning guide for electrical system loads (National Electrical Code).

Type of Occupancy	Lighting	Misc. Power
Hospitals (volt-amperes per square foot)	2.0-3.0	1.0
Hotels (volts-amperes per square foot)	1.0-2.5	0.5
Schools (volts-amperes per square foot)	1.5-3.5	0.25
Warehouses (volts-amperes per square foot)	0.25-1.0	0.25
Auditoriums (volts-amperes per square foot)	0.7-2.0	0.0
Restaurants (volts-amperes per square foot)	1.5-2.5	0.25

Services Requirements

Other services include transportation access, health and safety (including fire safety), security, custodial services, and other morale, welfare, and recreational-type services. As with underground utilities, these should be planned to minimize present and future costs while maximizing the value from these services. This section investigates the transportation access and health and safety requirements and suggests methods for macro-level planning in determining critical requirements for an Army installation. The Provost Marshal and other user staff agencies for physical security analysis and threat measurement can help determine security-related requirements.

Transportation Access

Transportation access planning at installations is similar to that of the public sector. At a macro-level, several elements of the installation determine the overall transportation plan. These include: mission, personnel, and geographical location. Mission plays an important role in determining the need for rail and/or air modes of transportation. Road design is also dictated by the mission since the types of vehicles, i.e., tanks, trucks, etc., determine the physical composition of the roads. Number of personnel plays a role in determining the quantity of transportation modes required to satisfy the flow of traffic. As a general rule of thumb, "the greater the personnel and installation size, the greater the transportation network required." Geographical location of the installation in relation to public transportation opportunities also plays a role in determining transportation access requirements. An installation close to a city with public transportation systems is easily accessible and thus does not require as many additional transportation modes.

Health and Safety

Health and safety requirements to satisfy OSHA guidelines need to be identified and included in the list of requirements. All other requirements should be verified to assure that they meet the OSHA criteria. Special consideration will be given to the design and location of facilities that involve the handling, manufacture, storage, and transportation of hazardous materials, such as ammunition, explosives, chemicals, and liquid propellants. Explosives safety coordination with Department of Defense Explosives Safety Board (DDESB) is required during the development of the requirements.

Fire safety requirements are identified based on NFPA life safety code and MIL-HDBK 1008, and other NFPA national fire codes. Factors to consider are the requirements for automatic sprinkler systems, fire alarm systems, and fire reporting systems based on the above criteria. Special attention should be given to fire areas, hazard of contents, means of egress, type of construction, and travel distances.

6 Commanders' Survey and HQRPLANS Studies

Commanders' Survey Background

As part of the overall Army facilities strategy, there is a need to articulate the relationship between facilities and the total Army mission. The basic problem is to better understand the relationship between facilities and Army readiness, warfighting, training, quality of life, and retention. Knowledge of these relationships is necessary to communicate facility needs for the best allocation of facilities resources and to justify facilities funding.

This research, a combined effort of U.S. Army Construction Engineering Research Laboratories (USACERL) and Massachusetts Institute of Technology (MIT), addressed the question of the role of facilities in the total Army mission by surveying installation commanders. The objective of the survey was to study the relationship between facilities parameters (facility type, quantity, quality, and utilization) and commander objectives. The only facility parameter modeled at the time of this research was maintenance cost. However, maintenance cost models do not often relate facility expenditures to commander objectives. Facilities expenditures are made on a "gut level" analysis without a formal model to assist the decisionmaker in prioritizing expenditures that will move the installation towards a higher achievement level for commander objectives.

Development of the survey began in June 1988 and continued through October 1989, when it was put on hold due to lack of funding. Work on the project resumed in August 1990, and in January 1991, MG Peter J. Offringa approved the survey. MACOMs support was requested, and they were asked to identify installations to participate in the survey. In July 1991, surveys were mailed to installations, but due to lack of response, surveys were redistributed in October 1991. In November 1991, completed surveys were sent to MIT for analysis.

Initially in the study, researchers visited Fort Leonard Wood (TRADOC) and Fort Polk (FORSCOM) and interviewed the Director and Deputy Director of Engineering and Housing, Chief of Engineering and Resource Management, and Chief and Master Planner of Engineering Plans and Services at each installation. The interviews led to a better understanding of the decision processes associated with the operation, maintenance, repair, renovation, and new construction of installation facilities. From this information, researchers developed a draft survey.

To ensure viability, researchers interviewed the following installation commanders: MG Van Loben Sels of Fort Monroe, LTG Wishart of Fort Leavenworth, MG Schroeder of Fort Leonard Wood, and LTG Stiner of Fort Bragg. Each Commander completed a questionnaire and made comments that were incorporated into the final draft (Appendix C). Surveys were distributed as follows: AMC (8), FORSCOM (20), TRADOC (6), U.S. Army Pacific (3), U.S. Army Korea - 8th (6), U.S. Army Europe - 7th (28), USARSO (4), U.S. Army Intelligence & Security (1), U.S. Army Information Systems (1). Seventy-seven surveys were mailed and 38 returned (49 percent response rate). The details of the survey results are included in the report of 15 July 1992 (Appendix D).

Commanders' Survey Overview

The questionnaire was divided into three core sections. In the first section on a scale of one to five, installation commanders were asked to rate the importance of eight objectives, the means of achieving their overall objectives, and the importance of organizational elements in achieving their overall objectives. The second section consisted of a series of three matrix questions, designed to address the identification of the fundamental relationship between facilities and commander objectives. Each question had three variables: facility characteristics, facility types, and commander objectives (Appendix D). In the third section, commanders were asked to rate a list of statements on a scale from one to five.

Commanders' Survey Results

Although significant diversity existed among installations and missions, there was considerable agreement among commanders regarding the importance of certain objectives, means of attaining objectives, and the organizational elements needed to accomplish objectives. Approximately three-quarters of the commanders responding to the survey selected quality of life as an objective of primary importance. This consensus shows a strong relationship between personal well-being and professional performance of the soldiers. Readiness, training, productivity, and statutory compliance were the next most commonly recognized as objectives of primary importance. These were rated as five by approximately one-half of the commanders. This reflects that readiness and training are perhaps the two most important objectives, while productivity and statutory compliance indicate future concerns. Over 85 percent of the commanders rated retention and awards programs as either 3 or 4, indicating that these objectives are of secondary importance (Appendix D, Figure 3).

Ninety-two percent of the responding commanders agreed that funding is a resource of primary importance as a means of establishing objectives, with facilities and personnel being next in importance (Appendix D, Figure 4). Equipment and land were seen as resources of secondary importance. At least one-half of the commanders rated the Directorates of Engineering and Housing, Resource Management, Personnel and Community Activities, and Logisitics as organizational elements of primary importance (Appendix D, Figure 5)

When commanders were asked to use their own terminology in specifying first, second, and third most important objectives, their responses were relatively uniform. The four most prominent objectives selected were: readiness, quality of life, training, and productivity. This shows strong agreement with Appendix D, Figure 3. Forty percent of the commanders reported readiness as being their most important objective, while only 8 percent specified it as second and 11 percent as third. Quality of life received a relatively consistent response across the three levels of importance: first objective 21 percent, second objective 26 percent, and third objective 32 percent.

The most important facility types related to the objectives or readiness and quality of life were examined in detail. Sixty-four percent of the commanders that selected readiness as their primary objective chose ranges and training grounds as the most important facility type in support of readiness. Of this 64 percent, approximately half stated that functional adequacy of ranges and training grounds was the most important facility characteristic. Quantity (36 percent) and physical condition (29 percent) of ranges and training grounds were the most frequently cited second and third facility characteristics, respectively.

Thirty-six percent of the commanders who chose readiness as one of the top three objectives selected maintenance facilities as the second most important facility type in achieving readiness. Of that 36 percent, about 38 percent indicated quantity and functional adequacy as their most important maintenance facility characteristics.

Twenty-seven percent of the commanders that selected readiness as one of their top three objectives reported maintenance facilities as the third most important facility type in achieving readiness at their installations.

HQRPLANS Study

HQRPLANS is an integrated database management system supporting HQDA and MACOM planners by providing them an automated capability to analyze facility assets and allowances, validate construction programs, forecast revitalization and maintenance, evaluate stationing proposals, and support base realignment studies. This is accomplished by joining information from several different information systems.

The following extract is from HQRPLANS on-line user's manual:

> Troop Data: The troop list for a given installation is derived from the Army's Structure and Manpower Allocation System (SAMAS) which documents the approved Army force structure. This troop list is published in the Army Stationing and Installation Plan (ASIP) and is incorporated in the HQRPLANS database. Authorization documents identifying quantitative and qualitative personnel and equipment data for this troop list are maintained in the Army Authorization and Documentation System (TAADS). Pertinent personnel and equipment information from TAADS, described in Tables of Organization and Equipment (TOE) and Tables of Distribution and Allowances (TDA), is also incorporated in HQRPLANS. This TAADS data is accessed through the automated Facilities Planning System (FPS).
>
> Real Property Data: Real property facility allowances for a given troop list are determined by applying authorized space planning criteria to each TOE/TDA organization included in the troop list as well as to tenants other than Army and Reserve Component training loads at each installation. The Army Criteria Tracking System (ACTS) is the primary source of space planning criteria. Where criteria in ACTS is missing or incomplete for a particular functional use, an approximation algorithm was statistically derived by examining the amount of space actually used at selected installations. Installation real property facility assets in the Headquarters Integrated Facilities System (HQIFS) are incorporated in the HQRPLANS database. HQRPLANS reports display HQIFS assets as either permanent, semipermanent, temporary or leased assets. Leased family housing is included in total installation assets. Leased facilities other than family housing are not included in total installation assets. Semipermanent assets at Eighth Army installations in Korea are displayed as permanent assets in HQRPLANS reports. Real property facility profiles containing the assets and allowances for each installation are the backbone of the HQRPLANS analysis capability. HQRPLANS groups real property assets according to functional purpose and unit of measure into Facility Category Groups (FCGs) for planning and programming purposes rather than the more familiar Facility Construction Category Codes in AR 415-28. HQRPLANS aggregates these category codes into FCGs and calculates facility assets and allowances at that level. This consolidation of category codes maintains

consistency with the system presently used for assets accounting and provides planners with sufficiently detailed analysis to support the decision process without creating an unnecessarily complex tool. HQRPLANS further aggregates FCGs into key real property facility Essential Elements of Analysis (EEAs) for macro analysis of large quantities of real property information.

A sample Troop List (Figure 4) shows that two major data types used in the HQRPLANS are organizations (or troops) that are assigned for each unique mission of the installation (or different level), and facilities supporting those organizations. By using these two key data elements, HQRPLANS estimates allowed assets for the organization based on the built-in algorithm of the system. This estimated quantity of the allowed asset constitutes a "Basic Facility to accomplish the mission for a specific organization." or "Core Installation." This estimate, then, is compared to the existing real property data derived from HQIFS to provide valuable reports necessary to analyze/solve the facility-related problems. All these data flow and analysis are provided on the "Functional Category Group" (or FCG) level of the facility category system. This level of detail maintains consistency with the system presently used for assets accounting and provides planners with sufficiently detailed analysis to support the decision process without creating an unnecessarily complex tool. The following process enables the RPLANS users to compare the existing real property facility asset data in HQIFS to facility allowances calculated from ASIP strengths and authorized space planning criteria (or built-in algorithms in HQRPLANS). HQRPLANS first tabulates all the UICs stationed within the selected installations (Figure 4).

Then, based on the built-in algorithms, HQRPLANS calculates all the necessary spaces for the troops selected from the list. These space requirements could be obtained in two different levels, EEA and FCG. These space requirements can then be compared to the existing real property asset data derived from HQIFS (Figure 5).

The next step helps deal with the installation facility deficit/excess problems. As a decision-support tool for this type of problem, HQRPLANS provides various kinds of reports. Further details are given in Appendix A "HQRPLANS Online User's Manual." Again, all of the reports provide information on the "Functional Category Group" Level.

HQRPLANS is a good tool for defining the relationship between Installation Organization and its Facility Utilization. Since HQRPLANS defines the space requirement of the installation based on the quality and quantity of the UIC (Unit Identification Code) stationed on it, it is relatively easy to define the Functional Size of a Core Installation. However, the reliability of this process depends solely on the accuracy of the algorithms that enable users to calculate the basic space requirements of each facility Functional Category Group. Since there are many algorithms yet to be approved for use, the quantity of the Estimated Allowed Asset is questionable. The other restriction in using HQRPLANS for the RPPAD purpose is that it does not use qualitative facility information. For the qualitative aspect of the facility, HQRPLANS uses Building Age Distribution only. Since a major portion of the relevant costs necessary to predict the RPMA costs, including Facility Revitalization Cost and Facility Maintenance Cost, are estimated using this parameter, accuracy of the result is questionable.

```
01/05/94                ASIP TROOP LIST ORDERED BY MACOM ASSIGNMENT                Database
HQRPLANS                      $ROCK ISLAND ARSENAL -- 17775                        Ver 3.21
                              AE -- ARMY ACQUISITION OFFICE
                                         FY 1993

                     CA                                         TOTAL   US  OTHER  TOTAL   TOTAL
MU  UIC       SRC    RS UNUM BR  DESCRIPTION    OFF   WOF   ENL   MIL   CIV   CIV    CIV     POP
-- ------ --------- -- ---- -- ------------- ----- ----- ------ ------ ------ ------ ------ -------
A  W27P04               W27P    MGRARMNTS        17     0     0     17   145      0    145     162
01/05/94                ASIP TROOP LIST ORDERED BY MACOM ASSIGNMENT                Database
HQRPLANS                      $ROCK ISLAND ARSENAL -- 17775                        Ver 3.21
                       AS -- US ARMY INTELLIGENCE & SECURITY COMMAND
                                         FY 1993
     Maintains consistency with the system presently used for assets accounting and provides planners with
sufficiently detailed analysis to support the decision process without creating an unnecessarily complex tool

                     CA                                         TOTAL   US  OTHER  TOTAL   TOTAL
MU  UIC       SRC    RS UNUM BR  DESCRIPTION    OFF   WOF   ENL   MIL   CIV   CIV    CIV     POP
-- ------ --------- -- ---- -- ------------- ----- ----- ------ ------ ------ ------ ------ -------
Y  W3S245               W3S2   BN USAINSCOM M     1     1     1      3     0      0      0       3
01/05/94                ASIP TROOP LIST ORDERED BY MACOM ASSIGNMENT                Database
HQRPLANS                      $ROCK ISLAND ARSENAL -- 17775                        Ver 3.21
                              AU -- US ARMY AUDIT AGENCY
                                         FY 1993

                     CA                                         TOTAL   US  OTHER  TOTAL   TOTAL
MU  UIC       SRC    RS UNUM BR  DESCRIPTION    OFF   WOF   ENL   MIL   CIV   CIV    CIV     POP
-- ------ --------- -- ---- -- ------------- ----- ----- ------ ------ ------ ------ ------ -------
Y  WONT!J               WONT   AGY USA AUDIT      0     0     0      0    18      0     18      18
01/05/94                ASIP TROOP LIST ORDERED BY MACOM ASSIGNMENT                Database
HQRPLANS                      $ROCK ISLAND ARSENAL -- 17775                        Ver 3.21
                            CE -- US ARMY CORPS OF ENGINEERS
                                         FY 1993


  US CIV population includes all US Civil Service authorizations or their
   equivalent.

$ = Installation selected from list of HQIFS installations.  Data displayed
    is for each selected HQIFS installation or ASIP station code only.
```

Figure 4. ASIP troop list ordered by MACOM Assignment.

01/05/94
Database
HQRPLANS
3.21

TABULATION OF EXISTING AND ALLOWED FACILITIES

EEA SUMMARY

Ver

Rock Island Arsenal -- 17775

FY 1993

EEA	EEA DESCRIPTION	UM	PERM ASSETS (000)	SEMI PERM ASSETS (000)	TEMP ASSETS (000)	AVAIL OFF POST HOUSING ASSETS	TOTAL ASSETS (000)	TOTAL LEASED ASSETS (000)	ALLOW (000)	PERM ASSETS - ALLOW (000)	TOTAL ASSETS - ALLOW (000)
110	RNWYS & TAXIWYS	SY	0	0	0	0	0	0	80	-80	-80
113	OTHR AF PVMNTS	SY	0	0	0	0	0	3	55	-55	-55
140	OPNS BLDGS	SF	0	0	0	0	0	2	9	-9	-9
141	UNIT OPS BLDG	SF	0	0	0	0	0	0	0	0	0
*170	TNG/INST BLDGS	SF	170	0	0	0	170	0	165	5	5
179	RNG/TNG AREAS	EA	1	0	0	0	1	0	0	1	1
17M	MANEUVER AREA	AC	0	0	0	0	0	0	0	0	0
*200	WASH FAC CENT	EA	0	0	0	0	0	0	1	-1	-1
210	AVN MAINT	SF	0	0	0	0	0	8	26	-26	-26
+212	GM MAINT BLDG	SF	0	0	0	0	0	0	0	0	0
*214	VEH MAINT	SF	147	0	0	0	147	0	128	19	19
+215	GUN/WPN REPAIR	SF	0	0	0	0	0	0	0	0	0
+216	AMMO MAINT FAC	SF	0	0	0	0	0	0	0	0	0
+220	MISC PROD BLDG	SF	2231	0	0	0	2231	0	2231	0	0
+229	CONST MAT PROD	EA	0	0	0	0	0	0	0	0	0
+300	RDT&E BUILDING	SF	22	0	0	0	22	0	22	0	0
+371	RDT&E RANGE FAC	EA	0	0	0	0	0	0	0	0	0
+390	OTHER RDT&E FAC	EA	0	0	0	0	0	0	0	0	0
*400	SUP/STOR FAC	SF	1984	1	0	0	1985	0	1508	477	478
*411	BULK FUEL STOR	BL	0	0	0	0	0	0	8384	-8384	-8384
*420	AMMO STORAGE	SF	3	0	0	0	3	0	0	3	3
*510	MED FAC	SF	17	0	0	0	17	0	24	-7	-7
650	GEN PURP ADMIN	SF	1373	0	0	0	1373	0	1082	291	291
*711	FAMILY HSG	SF	161	0	0	270	431	0	564	-403	-133
*71F	FAMILY HSG	FA	58	0	0	200	258	0	418	-360	-160
720	ENL UPH	SF	0	0	5	0	5	9	16	-16	-11
*721	OTHER UPH	SF	1	0	0	0	1	0	30	-29	-29
722	DINING	SF	0	0	0	0	0	0	1	-1	-1
72P	ENL UPH (ASGMT)	PN	0	0	15	0	15	22	80	-80	-65
72S	ENL UPH (2+2)	PN	0	0	0	0	0	0	80	-80	-80
*72X	OTHER UPH	PN	2	0	0	0	2	0	82	-80	-80
730	PERSONNEL SUP B	SF	13	0	0	0	13	0	20	-7	-7
*740	COMMUNITY SUP	SF	225	0	0	0	225	0	269	-44	-44
*750	ATHLETIC FIELDS	EA	6	0	0	0	6	0	12	-6	-6
*80G	UTILITIES	KG	4754	0	8000	0	12754	0	7094	-2340	5660
*80K	UTILITIES	KV	42530	0	21748	0	64278	0	26082	16448	38196
*80L	UTILITIES	LF	455	0	0	0	455	0	1794	-1338	-1338
+80M	UTILITIES	MB	366	0	0	0	366	0	366	0	0
*850	VEH PVMNTS	SY	710	0	0	0	710	0	2763	-2053	-2053

* = EEA contains one or more unvalidated space planning algorithms at the FCG level.

+ = HQRPLANS/RPLANS Allowances = Total Installation Assets.

Family housing assets data for available off-post assets was provided to DAIM-FDP-A by the MACOMs as of October 1992 and is displayed under EEA 71F/FCG 7110F in this report in lieu of any other sources. The 2+2 capacity of permanent enlisted barracks was also provided by the MACOMs and is displayed under EEA 72S/FCG 7210S in this report.

TEMP and TOTAL ASSETS include commercial/privately-owned sources for utilities. TOTAL ASSETS include leased family housing and available off-post, privately-owned family housing.

Figure 5. Tabulation of existing and allowed facilities.

7 Decision-Support Methods/Models To Determine Critical Requirements

Requirements forecasting is the baseline for the entire master plan. The key to the overall forecast is the character of the basic operation, total requirements, and staged development of the installation. Basic operations depend on missions and their characteristics. Total requirements include land, infrastructure, facilities, and services requirements. They may be sustainment requirements, improvement requirements, acquisition requirements, diversion/conversion requirements, and disposal requirements. The staged development depends on mission requirements and criticality, condition of the existing facilities, costs of development, and availability of alternatives. There are several decisions at every step of forecasting and the master planning process. This chapter will discuss three decision-support methods/models in determining the critical requirements: Simulation, Analytic Hierarchy Process (AHP), and the Systems Approach.

Simulation

Simulation is one of the methods that can help determine critical requirements. Requirements analysis and estimation is the basis for any long-range plan. Figure 6 shows the installation long-range planning process. IFS-M provides the inventory of existing facilities. Regional planners around the post have facilities and other planning information for their regions. The installations develop the requirements with this existing information. To forecast future requirements, they need to know future missions. ALRPG, AG, and TAP provide direction and objectives for future requirements development and long-range planning. ASIP provides missions and population information, which is used to determine facilities and services requirements to meet those missions.

The long-range planning process determines requirements using all this information. The next step is to include regional trends impact on these requirements. Environmental, demographic, technical, real estate, and economic trends in the surrounding areas all impact the requirements. Planning scenarios are developed using all this information, and are then compared to get the best value. The scenario giving the best value will be the preferred strategy for developing the long-range-plans.

A computer simulation technique is useful as a decision-support tool in this long-range planning process. It provides a powerful tool that allows the user to review the existing and potential installation capabilities and adaptability to changing missions and trends, and to explore alternative planning and management actions to satisfy management goals with minimum costs. This simulation requires graphics data to identify the location, distance, etc. It can show the impact of alternative scenarios on existing missions and facilities. If a real estate trend shows high-rise buildings close to the base on one side, the impact of that trend on missions such as training or alternative strategies to minimize any negative impact can be evaluated using this simulation technique.

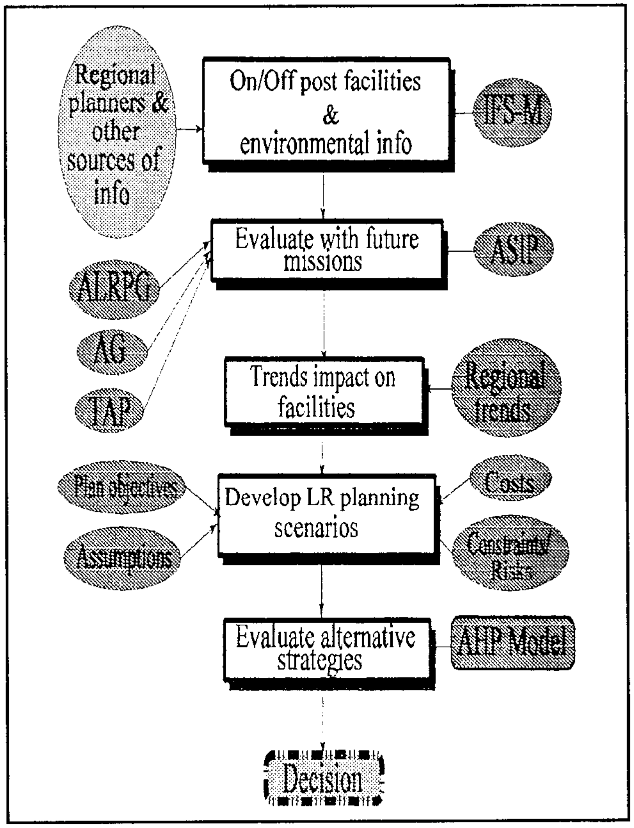

Figure 6. Long-range planning process simulation.

This approach should have certain basic characteristics. One of the most important characteristics is the capability to address future uncertainty and incorporate a robust set of possible events for each solution set. This type of simulation analysis will help determine what is best for the installation in the future. This methodology should make full use of acceptable and reliable data, forecasting methods, and engineering estimates. In addition, the assumptions should be readily apparent and easily transformed to accommodate any changes or additions. It should be capable of addressing many installation planning and management issues such as traffic pattern simulation, fire hazard, capabilities of facilities including utilities and land, environmental impact, and noise impact simulation. Finally, the methodology should provide a means to assess the impact of small changes on the solution, especially the resource implications to support each solution. Scenario analysis will be used in this simulation approach to determine the facilities and services required and the impact on the installation and surrounding community. The tradeoffs of alternative scenarios will be apparent to the user with graphic data presentation using simulation.

The requirements analysis for master planning is a complex system with a collection of interrelated components that interact in a collective effort to achieve some goal. The algorithms need to be included to simulate the behavior of these components to arrive either at a particular numerical value or at an analytic solution.

Its development is, therefore, a long-term effort in which both the simulation tool and the organization that it uses will undergo evolutionary changes. The reason for this is that decision-support tools like the one described here have the capability and are designed to integrate the information sources throughout the organization to support the decisionmaking function.

Simulation decision-support tools, therefore, must be developed using a so-called "divide and conquer" strategy. Specifically, different functional areas of installation development and design first have to be identified and separately analyzed, for example: utilities, transportation, natural resources, demographics, etc. From the simulation tool development perspective, each functional area can be described using a set of major entities and their relationships. Data sources for each of these areas should also be identified as well as sources of knowledge about the behavior of entities used to describe the function. All this suggests that the object-oriented methodology would be the best one to use not only for the tool development but for the analysis of the problem as well. Object-oriented analysis is not only the state-of-the-art methodology in simulation, but more importantly, as part of the information technology "toolbox," it provides easy open links to the variety of other information technology tools this decision tool needs: graphical user interfaces tools, database tools, knowledge-based systems tools, and communication resources utilization tools.

The next major step in simulation tool development is to identify the most important relationships (functional relationships and impacts between functions) among those functional areas of the installation as the complex system. This step can be undertaken after the functional analysis step and entity-relationship modeling step is completed. Due to the complexity of the system being described, it is expected that this step will necessitate a change of the model developed in the previous step—a natural sequence of events in the development of these kinds of tools.

To demonstrate the impact of this tool on decisionmaking, a rapid prototyping of the tool that would contain just a few key functions of a typical installation is recommended. Such a prototype would demonstrate the need for such a tool a also provide the guidelines for future development of the simulation decision-support tool.

Analytic Hierarchy Process

Another decision-support tool that can help a decisionmaker evaluate alternative strategies to determine critical requirements is the Analytic Hierarchy Process (AHP).

AHP involves comparison of two attributes at a time. The relative importance of one to the other one is expressed in narrative terms, then Table 6 is used to convert these descriptions into numerical values.

The master plan and planning scenarios for the entire installation provide the integrated solutions for the development and maintenance of the installation facilities, land, and services, which is the foundation for determining critical requirements. The analysis of these planning scenarios requires more than quantitative analysis, since most of the decisions are based on quantitative as well as qualitative analysis. AHP is a decision method that can evaluate each aspect of the decision to make tradeoffs-some quantitative, some qualitative, some very important, and some not so important.

AHP makes it possible for the decisionmaker to structure the decision problem (objectives, criteria, data, and importance of the objectives) in a logical hierarchical structure. Basically, the structure of the decision problem in AHP can be distinguished into three parts:

1. **Overall goal:** the overall objective of the decision analysis, i.e., "Our goal is to find the best planning scenario for the ARMY installation"
2. **Attributes (criteria):** specify attributes that can measure the success of the goal. Each attribute can be subdivided into sub-attributes. In this example, the attributes to evaluate planning scenarios are: (a) maximizing mission performance (MMP), (b) minimizing life cycle costs (MLCC), (c) maximizing morale, welfare and recreation (MMWR), and (d) maximizing aesthetics (MAES). The factors that affect the mission performance are subattributes to the MMP.

Table 6. Numerical values for relative importance of attributes.

Relative Importance	Definition	Explanation
1	Equal importance	Two attributes contribute equally
3	Weak importance	An element is slightly favored over another
5	Strong importance	An element is strongly favored over another
7	Very strong importance	An element is strongly dominant
9	Extreme importance	Highest possible order of importance
2,4,6,8	Intermediate values between two adjacent judgements.	Compromise is needed between two judgements
Reciprocals	Reciprocal value in importance	If i has one of the preceding numbers when compared with j, then j has the reciprocalvalue when compared with i

3. **The set of alternatives:** a set of choices, from which the decision will be drawn. AHP will rank them with respect to the criteria. This example assumes three alternative scenarios for the installation planning. These three alternative scenarios then will be analyzed from the standpoint of those four attributes above. Figure 7 shows the hierarchy of the decision problem.

To solve the decision problem, the relative importance of the criteria is first weighted with respect to the overall goal. In this case, the weights of the attributes to evaluate planning scenarios (MMP, MLCC, MMWR, MAES) are determined. The pairwise comparisons of these attributes establish the weight of the attributes. Next, the pairwise comparison method is also used to determine the score of alternative scenarios with respect to each attribute. Finally, based on the weights of the attributes and scores of the alternative scenarios with respect to each attribute, these answers are synthesized to obtain the priority list of the scenarios. The priority list of these planning scenarios will help to choose the best strategy, i.e., the one with the highest priority index. The pairwise comparison's matrix (Table 7) shows the four attributes with respect to the goal in the example.

Using the scale given in Table 6, the decisionmaker fills the matrix by putting "ones" in the diagonal positions as indicated in Table 7, and the comparison values in other boxes. For example, to compute MLCC entry for row 1 (MMP), the decisionmaker is asked, "How important is MMP compared to MLCC?" If the answer is "slightly more important," put 3 in the cell at row 1, column 2. Likewise, if MMP has very strong importance compared to MMWR, put 7 in the cell at row 1, column 3. Next, the

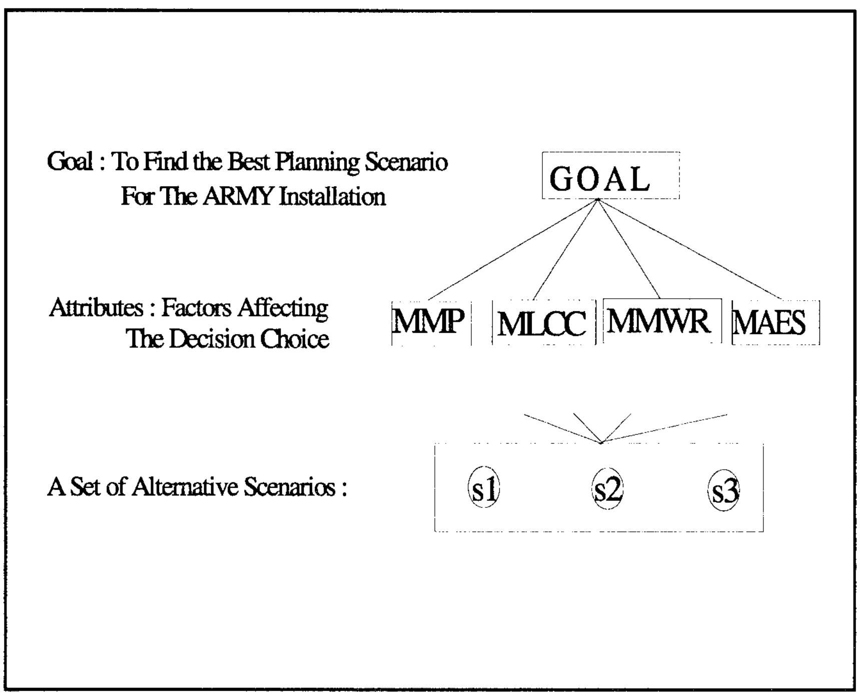

Figure 7. The hierarchy of the decision problem.

Table 7. A pairwise-comparison matrix of the attributes with respect to the goal.

	MMP	MLCC	MMWR	MAES
MMP	1	3	7	9
MLCC	1/3	1	5	7
MMWR	1/7	1/5	1	3
MAES	1/9	1/7	1/3	1

decisionmaker states MMP is extremely important compared to MAES, so put 9 in the cell at row 1, column 4. Complete the other rows in the same fashion.

This elicitation process collects redundant information, which is used for consistency checks. AHP provides means for computing a consistency ratio, which indicates whether the results are acceptable or not. After eliciting the comparisons and constructing the matrix in Table 7, weights are determined by the following two operations:

1. Normalize each column by dividing each entry in the column by the sum of all entries in that column
2. Take the average of all entries in each row of the normalized matrix; This determines the weight of the attribute in that row.

The matrix given in Table 7 yields the following weights: MP (0.58), MLCC (0.29), MMWR (0.085), and MAES (0.042). The sample data in Table 7 show that MMP is the most important criterion (with weight 0.58) for selecting a planning scenario among alternatives. The next step is to create priority list of the scenarios with respect to each attribute. They are also obtained by calculating the eigenvector of the matrix with respect to each attribute comparing the alternative scenarios.

Table 8 shows a matrix with the pairwise comparisons of three scenarios with respect to attribute MMP. The four attributes yield four matrices that show pairwise comparisons of alternative scenarios, one with respect to each attribute. Calculating the eigenvector of the matrix in Table 8, yields the following scores: scenario 1 (0.64), scenario 2 (0.26), and scenario 3 (0.10). With respect to the attribute of maximizing mission performance, the priority list of the scenarios shows that scenario 1 is the best installation planning strategy.

Following the same procedure gives eigenvectors or the priority list of scenarios with respect to the other attributes. The last step is to synthesize the results. To do this step, the eigenvectors of the scenarios are multiplied by the eigenvector of the

Table 8. A pairwise-comparison matrix of the scenarios with respect to the MMP attribute.

	Strategy 1	Strategy 2	Strategy 3
Strategy 1	1	3	5
Strategy 2	1/3	1	3
Strategy 3	1/5	1/3	1

attributes. This procedure will result in the overall priority list of the scenarios. The synthesis of the decision problem gives us the following priority list of strategies: strategy 1 (0.47), strategy 2 (0.27), and strategy 3 (0.26). For the four attributes of Army installation planning, the priorities listed above show that strategy 1 is the best strategy with the highest priority index of 0.47.

Once the strategy for installation planning is selected, the requirements (facilities, land, services, etc.) are determined to meet that strategy. It is also possible to use this technique to determine the requirements. In this case, alternative ways of meeting a requirement are analyzed using AHP to select a method to satisfy the requirement. This method is particularly applicable when the decision problem is complex and multiple objectives and tradeoffs must be made among alternatives.

Systems Approach

The systems approach concentrates on the analysis and design of the system as a whole to achieve some objective rather than considering each component independently. Every system is a component or a subsystem of some larger and more complex system. To analyze a system, one must consider the system in isolation from the environment that establishes the constraints on the system, including all inputs to it and the outputs from it. This is a common sense approach in that each concept and each step are logical and reasonable. The value of the systems approach is that it allows the user to bring all these common-sense ideas together to focus on the resolution of complex problems.

An Army installation master plan is a system. The objective of an installation master plan is to provide the facilities, utilities, access, safety, security, good neighborhoods, and good image needed to support the missions and communities of that installation. The components of this system are: transportation system, electrical system, space management system, communication system, fire safety management system, etc. The deficiencies in these components make it difficult to achieve the overall objective, and therefore generate facilities and services requirements.

To identify and analyze facilities and services requirements, one must take a systematic view of how all components contribute to the total system (master plan). Figure 8 illustrates the concept of developing total requirements using systems approach. The total requirements include buildings, infrastructure, land/environment, and services requirements. These requirements are the combination of sustainment requirements, improvement requirements, conversion requirements, acquisition requirements, and disposal requirements.

The determination of these total requirements is performed by examining a number of factors such as availability of facilities, physical and functional condition of those facilities, etc. For example, if a new mission requires a type of facility of a specified size, and if that type of facilities on the base are fully utilized, no compatible facilities are available, and no other nearby (off post or other DOD facilities) suitable facilities, then the acquisition of that facility becomes a requirement. Develop sustainment, improvement, conversion, and disposal requirements of all types (buildings, infrastructure, land, environment, and services) to generate total requirements using similar systems approach. Keeping track of the requirement type, and its estimated cost (preliminary estimate) will benefit further requirements analysis and resource allocation decisions.

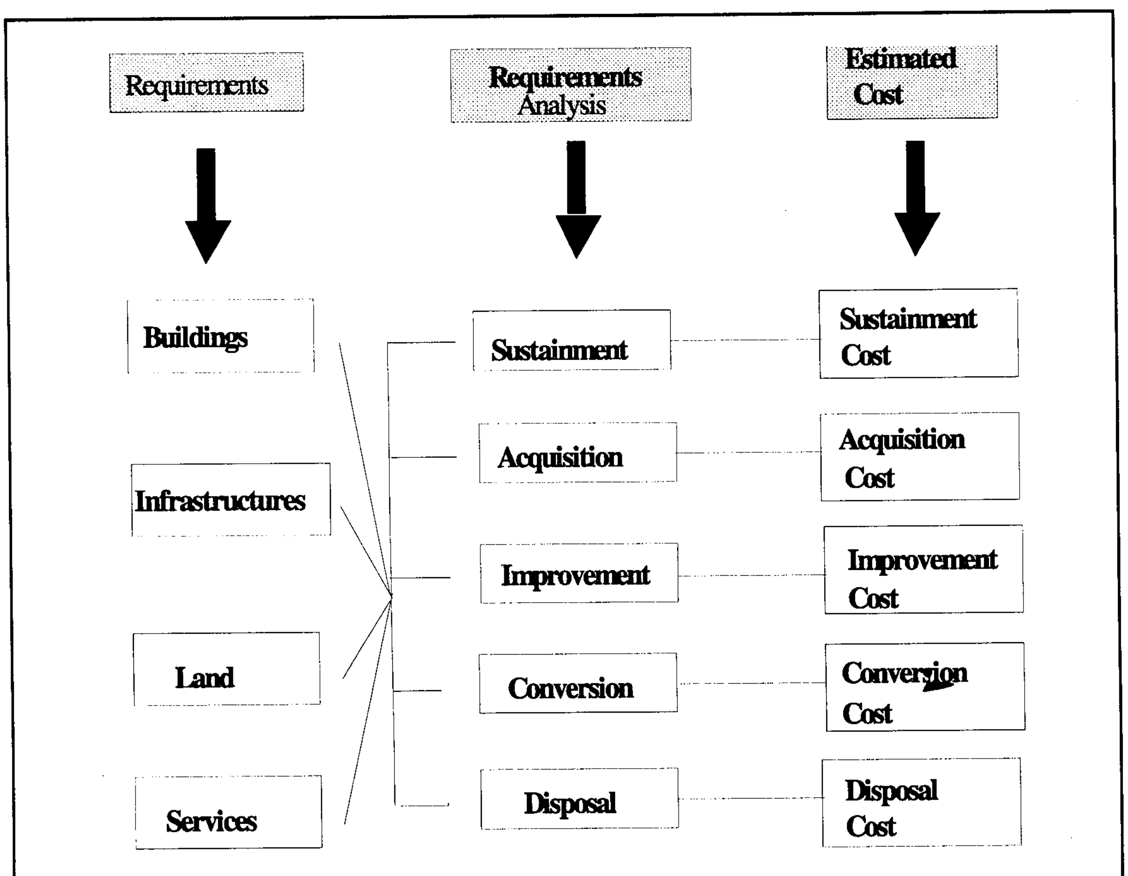

Figure 8. Determining an installation's total requirements.

After the total requirements are identified, the system needs to prioritize these requirements to determine their criticality. This can be done by providing a capability to prioritize the requirements. Imagine that an installation has a specified amount R to spend on projects. The objective of this subsystem of prioritization is to accept all projects that do not exceed the cost constraint R that can provide maximum benefits. Project selection and resource allocation problems will have the same basic structure. Since R is a constraint on the system, the requirements can be prioritized based on the benefit or value they contribute to the overall system.

Major factors to be included to obtain a benefit from fulfilling requirements need to be identified, and a scoring mechanism needs to be determined. Figure 9 shows a sample screen of the model to prioritize the requirements with the attributes. If the requirement is to support health and safety, and the risk is high enough to be between "high risk" and "catastrophic," the user selects "7" as the score. A high risk score is "6." and the score for catastrophic problem is "8" as displayed on the screen. This score reflects the health and safety problem intensity if the requirement is not fulfilled. Each requirement will have a score based on its characteristics. The scores of the requirements are used to prioritize them, and the requirements with high scores are critical requirements. The factors for determining need, the points, risk levels, etc. are developed for research purposes using the current guidance, type of projects, and

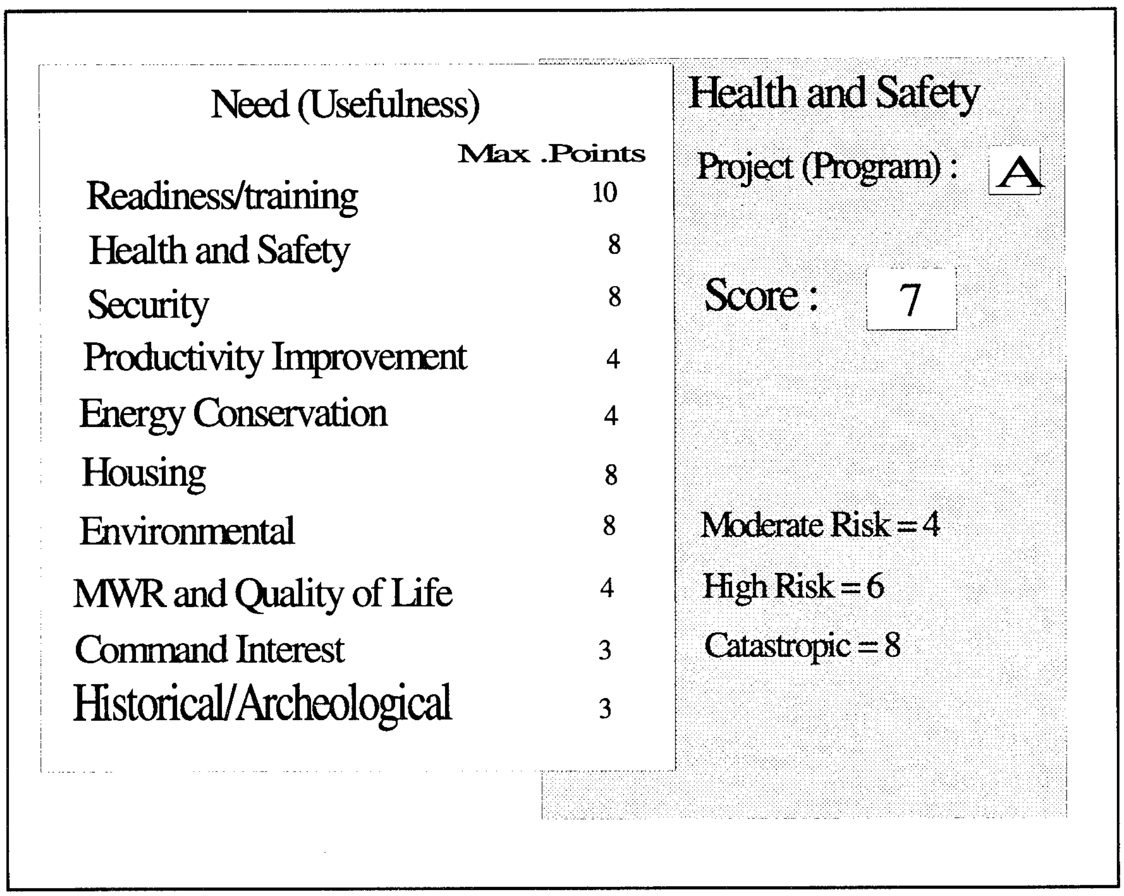

Figure 9. Decision support for prioritizing requirements.

commanders survey results. Implementation of a similar model in a system requires policy decisions on the factors, points, and risk levels.

The type of requirements and their criticality (points) will be aggregated for each type and criticality level for DA or MACOM approval and funding decisions. The estimated costs for each type of requirement are also aggregated to provide needed information to HQ on dollar impact. The systematic accumulation of data about facilities and services requirements in a form that makes them comparable and relevant to management objectives is the major advantage of this systems approach.

8 Summary and Conclusions

Determining Requirements

This study identified methods to determine the critical requirements for standard types of Army installations. Long-range planning practices used by city governments and Army installations were studied and compared. In both cases, long-range planning is primarily a way to forecast future community development. A city long-range plan or (the corresponding) Army installation master plan both focus on defining facilities and services requirements, and both set a direction and strategy to meet those requirements. Adequately defining these requirements is the key to satisfying facility needs for mission accomplishment.

Several sources of facilities planning guidance provide direction and criteria for developing facilities requirements. Total requirements involve a collection of complexly interrelated components that work together to achieve some goal. The condition and adequacy of existing facilities, land, environment, infrastructure, and services must all be considered to determine such specific requirements as: sustainment, improvement, acquisition, diversion/conversion, and disposal requirements.

The first step in determining critical requirements is to identify total requirements. Next, individual requirements are prioritized, based on the benefit or value they contribute to the overall system, to establish their criticality. Two installation and HQ-level automated master planning tools already generate requirements based on quantitative criteria: RPLANS and HQRPLANS. These tools provide a good starting point, but, to identify critical requirements, the analytical scope must be broadened to include qualitative aspects of the requirements such as safety, security, and environmental problems.

Once total requirements are identified, a system must be devised to prioritize and determine the criticality of each requirement. This study identified three decision-support methods/models to help determine a requirement's criticality: Simulation, the Analytic Hierarchy Process (AHP), and the Systems Approach.

Determining Criticality

Simulation

A computer simulation technique may be useful in determining requirements. Simulation is a powerful tool that can allow the user to review existing and potential installation capabilities and adaptability to changing missions and trends, and to explore alternative planning and management actions that will satisfy management goals at a minimum cost. Identifying alternative planning actions is a vital step that leads to the development of facilities and services requirements.

Such a computer simulation will require graphical as well as analytical data to represent logistical data (a facility's size and location, distance between facilities, etc.), and to show the impact of alternative scenarios on existing missions and facilities. Simulation decision-support tools must use a "divide and conquer" strategy to identify and separately analyze different functional areas of installation development and design, e.g., utilities, transportation, natural resources, demographics, etc.

This study recommends a rapid prototyping of a tool that would contain just a few key functions of a typical installation to clearly demonstrate the impact of this tool on decisionmaking and also to provide the guidelines for future development of a simulation decision-support tool.

Analytic Hierarchy Process

Another decision-support tool that can help a decisionmaker evaluate alternative strategies to determine critical requirements is the Analytic Hierarchy Process (AHP). The master plan and planning scenarios for the entire installation provide the integrated solutions for developing and maintaining installation facilities, land, and services. These planning mechanisms also form the foundation that determines critical requirements.

AHP goes beyond a simple quantitative analysis; it is a decision method that can evaluate each aspect of the decision to make tradeoffs—some quantitative, some qualitative, of greater or lesser importance. AHP enables the decisionmaker to structure the decision problem (objectives, criteria, data, and importance of objectives) in a logical-hierarchical structure. AHP will rank the alternatives with respect to the criteria using a pairwise comparison, indicating the best strategy as the one with the highest priority index.

Once the strategy for installation planning is selected, then the requirements (facilities, land, services, etc.) are determined to meet that strategy. This technique can also determine the requirements. In this case, alternative ways of meeting a requirement are analyzed using AHP to select a method to satisfy the requirement. This method is particularly applicable to complex decision problems including multiple objectives and tradeoffs among various alternatives.

Systems Approach

The last decision-support method to determine critical requirements is the Systems Approach. To analyze a system, one must consider it in isolation from the environment that establishes the constraints on the system including all inputs to it as well as the outputs from it. The Systems Approach, however, concentrates on the analysis and design of the system as a whole to achieve some objective, rather than considering each component independently. Every system is seen as a component or subsystem of some larger and more complex system.

This approach treats an installation master plan as a system, the objective of which is to provide all facilities, utilities, access, safety, security, good neighborhoods, and good image that support the missions and communities of that installation. The system components are the many sub-systems that make up the whole: the transportation system, electrical system, space-management system, communication system, fire-safety management system, etc. The Systems Approach incorporates a vital element into the decisionmaking process, the fact that deficiencies in any one component can generate facilities and services requirements, and thereby prevent an installation from achieving its overall objective.

A Consolidated System

This study concludes that it is possible to develop a computer system with the combined capabilities of Simulation, AHP, and the Systems Approach to determine critical requirements. System objectives, criteria, and constraints still need to be identified by policy makers in coordination with installations. Once in place, such a system will give installation managers the ability to logically and efficiently structure installation development and management. Policymakers and HQ will also benefit from the system's enhanced ability to aid in requirements analysis, stationing, and resource allocation decisionmaking.

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Appendix A: Meeting With Village of Rantoul Planners (23 September 1993)

ATTENDED BY:

Ret. USAF Maj. General Frank Elliot
Daniel Culkin - Village of Rantoul Building Official
Ellen Piety - USACERL
Joyce Baird - USACERL
Victoria McCleary - USACERL
Samuel Ariaratnam - USACERL

Major Points of Discussion

- 1,322 housing units at Chanute AF base
- Rantoul population was 17,000 and is now 12,000 with base closure
- Chanute AF base consists of 2,200 acres of land
- Public Law 100-526 dictates rules for closing of property
- Politics dictates "entire" closure, rather than "partial" closure
- Goal is to try and get more buildings on base under property tax rules to generate money for village
- Need to upgrade codes for family housing on Chanute AF base to bring up to standards
- During disposal, land is zoned (i.e., commercial, educational, recreational, etc.) and sold as a whole by public bid to highest bidder
- Land is appraised by GSA personnel to assess fair market value taking into consideration upgrading costs to developers, etc.
- Buyer is responsible for all utilities on parcel purchased
- Waste water system is shared by Chanute AF base and Village of Rantoul
- There are five water wells on Chanute AF base property
- Some land was given to Village of Rantoul (i.e., all runways, some park land, etc.)
- Underground utilities on Chanute AF base are a mess (straight line is the closest distance between two points)—resulting in some utilities going through land rather than easements
- Air Force classifies buildings from inspections into categories (1 to 5)

- A 5 facility is considered "poor" and has all utilities shut off during closure, whereas 1 facilities maintain all utilities to prevent additional degradation
- Economic Development Committee (EDC) gives grants to communities affected by base closures

Appendix B: Meeting with City of Champaign Planner (14 September 1993)

Attended by:

Matt Flynn - City of Champaign Planning Department
Joyce Baird - USACERL
Samuel Ariaratnam - USACERL
Victoria McCleary - USACERL.

Major Points of Discussion

The main goals for the city planning:

- Public safety
- Uilities
- Transportation network
- Waste disposal.

The Core Elements of a City

- Police, fire, hospitals, schools, houses, utilities, road networks, etc.
- The planning process for the city:
  - Solicit input from residents of each city zone
  - Develop a long-term 20 year plan which is updated every 5 years.

Methods Used for Planning for Expansion or Contraction

- Study existing land-use areas (zones)
- Cake into consideration drainage patterns, sewer plants, etc.
- Methods used for determining the needed amount of fire protection, security, schools

- Fire protection: need to look at time to respond to all areas of city (< 4.5 minutes)
- Police force: central police station with detailed patrol routes
- Schools: the days of neighborhood schools are over, now busing is the cost efficient alternative.

General Questions

Q: How are utility needs planned for and who provides the utilities (public or private)?

A: The city of Champaign uses private utility companies, however, some cities such as Green Bay, Wisconsin used public utilities.

Q: Does the city provide for any medical care or is all medical care provided from private sources?

A: The city of Champaign does not have any hospitals, however, private clinics do exist within Champaign city limits (Carle/Covenant hospitals are in Urbana).

Appendix C: Commanders' Survey

Survey of Installation Commanders

Identifying the Relationship Between Commander Objectives and Facility Characteristics

U.S. Army Corps of Engineers
Construction Engineering Research Laboratory
and
Massachusetts Institute of Technology

INTRODUCTION

The relationship between commander objectives (*i.e., readiness, quality of life, retention*) and facility characteristics (*i.e., facility type, quantity/amount, physical condition*) is not well understood. There is no system for comparing the achievement of commander objectives under different facility strategies. The purpose of this questionnaire is to define the relationship between commander objectives and facility characteristics in a form that can be used in the development of practical decision support tools. Ultimately, these tools will provide the capability to predict the impact of facility management decisions on the achievement of commander objectives.

This questionnaire is directed solely towards installation commanders. It is their experience and opinions that will make the results valid and useful. The Director of Engineering and Housing will be receiving a similar questionnaire.

All responses will be handled in a confidential manner. No names of individual respondents or installations will be used in the presentation of results.

Name: ______________________________

Rank: ______________________________

Installation: ______________________________

Location: ______________________________

POINT OF CONTACT

For additional information about this study or any specific questions concerning this survey, please contact Ms. Joyce Baird, U.S. Army Construction Engineering Research Laboratory, 1-800-USA-CERL.

1. Given your installation's mission, rate the following types of **OBJECTIVES** in terms of their importance to you as an installation commander. (*Please circle the appropriate number for each item*)

OBJECTIVES	Less Important				More Important
Readiness	1	2	3	4	5
Training	1	2	3	4	5
Productivity	1	2	3	4	5
Quality of Life	1	2	3	4	5
Retention	1	2	3	4	5
Awards Programs	1	2	3	4	5
Statutory Compliance	1	2	3	4	5
Force Modernization	1	2	3	4	5
Profitability (*i.e., self-supporting MWR facilities*)	1	2	3	4	5
Other ____________ (*please specify*)	1	2	3	4	5
Other ____________ (*please specify*)	1	2	3	4	5

2. Given your installation's mission, rate the importance of the following types of **MEANS** in achieving your overall **OBJECTIVES** as an installation commander. (*Please circle the appropriate number for each item*)

MEANS	Less Important				More Important
Land	1	2	3	4	5
Facilities	1	2	3	4	5
Equipment	1	2	3	4	5
Personnel	1	2	3	4	5
Funding	1	2	3	4	5
Other ____________ (*please specify*)	1	2	3	4	5
Other ____________ (*please specify*)	1	2	3	4	5

3. Given your installation's mission, rate the importance of the following **ORGANIZATIONAL ELEMENTS** in achieving your overall **OBJECTIVES** as an installation commander. (*Please circle the appropriate number for each item*)

ORGANIZATIONAL ELEMENTS	Less Important				More Important
Headquarters Command (HQ CMD)	1	2	3	4	5
Major Subordinate Commanders	1	2	3	4	5
Resource Management (DRM)	1	2	3	4	5
Engineering & Housing (DEH)	1	2	3	4	5
Personnel & Community Activities (DPCA)	1	2	3	4	5
Plans, Training, & Mobilization (DPTM)	1	2	3	4	5
Security (DSEC)	1	2	3	4	5
Logistics (DOL)	1	2	3	4	5
Provost Marshal's Office (PMO)	1	2	3	4	5
Information Management (DOIM)	1	2	3	4	5
Reserve Component Support (DRCS)	1	2	3	4	5
Contracting (DOC)	1	2	3	4	5
Other ____________ (*please specify*)	1	2	3	4	5
Other ____________ (*please specify*)	1	2	3	4	5

INSTRUCTIONS FOR QUESTIONS 4A, 4B & 4C

Based on your current installation command, fill in your first, second, and third most important **OBJECTIVES** in the appropriately marked red boxes in questions 4A, 4B and 4C, respectively. See example. *A list of possible commander objectives can be referenced in question 1, but please feel free to fill in different objectives using your own terminology.*

In achieving each of these three **OBJECTIVES**, identify the 1st, 2nd, and 3rd most important **FACILITY TYPES** available to you as an installation commander. Three responses are required in each blue column in questions 4A, 4B and 4C. See example. *For further explanation of any one facility type please refer to the inside back cover page.*

Note that each facility type in questions 4A, 4B and 4C has a corresponding yellow row of facility characteristics. Please identify the 1st, 2nd, and 3rd most important **CHARACTERISTICS** of each of the three **FACILITY TYPES** you identified in each question. A total of nine responses are required for this part of each question, three per facility type. See example. *For further explanation of any one characteristic please refer to the inside back cover page.*

EXAMPLE: The following example indicates that "Readiness" is currently your most important objective as an installation commander. You believe that "Classroom Facilities" is your most important facility type for achieving "Readiness" at your installation, with "Ranges & Training Grounds" and "Administrative Facilities" being your 2nd and 3rd most important facility types, respectively. In your evaluation of how "Classroom Facilities" help you achieve "Readiness" at your installation, you believe that it is most important to have an adequate "Amount" of "Classroom Facilities," it is 2nd most important to have them in good "Physical Condition," and it is 3rd most important for them to "Function Adequately." The same principal applies for the characteristics that are specified for "Ranges & Training Grounds" and "Administrative Facilities."

(EXAMPLE)
FIRST OBJECTIVE

READINESS

FACILITY CHARACTERISTICS

		Quantity/ Amount	Functional Adequacy	Physical Condition	Manage- ability	Flexibility
2	Ranges & Training Grounds	2	1			3
1	Classroom Facilities	1	3	2		
	Maintenance Facilities					
	Medical Facilities					
3	Administrative Facilities		3	1	2	

4A. FIRST OBJECTIVE

FACILITY CHARACTERISTICS

	Quantity/ Amount	Functional Adequacy	Physical Condition	Manage-ability	Flexibility	Appearance	Location/ Proximity
Ranges & Training Grounds							
Classroom Facilities							
Maintenance Facilities							
Medical Facilities							
Administrative Facilities							
Operational Facilities							
Storage Facilities							
Utility Systems							
M. W. R. Facilities							
Family Housing							
Other Housing							
R & D Facilities							

4B. SECOND OBJECTIVE

FACILITY CHARACTERISTICS

	Quantity/ Amount	Functional Adequacy	Physical Condition	Manage-ability	Flexibility	Appearance	Location/ Proximity
Ranges & Training Grounds							
Classroom Facilities							
Maintenance Facilities							
Medical Facilities							
Administrative Facilities							
Operational Facilities							
Storage Facilities							
Utility Systems							
M. W. R. Facilities							
Family Housing							
Other Housing							
R & D Facilities							

4C. THIRD OBJECTIVE

FACILITY CHARACTERISTICS

	Quantity/ Amount	Functional Adequacy	Physical Condition	Manage-ability	Flexibility	Appearance	Location/ Proximity
Ranges & Training Grounds							
Classroom Facilities							
Maintenance Facilities							
Medical Facilities							
Administrative Facilities							
Operational Facilities							
Storage Facilities							
Utility Systems							
M. W. R. Facilities							
Family Housing							
Other Housing							
R & D Facilities							

5. Please evaluate the following statements:
(*Please circle the appropriate number for each statement*)

	Strongly Disagree	Mostly Disagree	Neutral	Mostly Agree	Strongly Agree
a. Real property decision making, on average, plays a critical part in the overall performance of my installation.	1	2	3	4	5
b. I do not have sufficient information or methodology available to clearly evaluate the physical performance or use effectiveness of my installation facilities.	1	2	3	4	5
c. The "time horizon" or planning period that I typically base my objectives on is defined by my tenure as installation commander.	1	2	3	4	5
d. My installation's investment in such facilities oriented programs as "Communities of Excellence" is having a strong positive impact on the achievement of my overall objectives as commander.	1	2	3	4	5
e. Many of the regulations that are in place are hindering me from making better facility related decisions (*i.e., RPMF*).	1	2	3	4	5
f. The method by which new construction projects are prioritized at my installation can be improved upon to better support my objectives.	1	2	3	4	5
g. I am provided adequate information for assessing the impacts of funding recommendations made by the Program and Budget Advisory Committee (*PBAC Process*).	1	2	3	4	5

Thank you for completing this survey. We would welcome any additional comments that you feel might be useful to this study.

____

If you would be willing to answer additional questions, please provide your telephone number ____________________.
All respondents will be sent a copy of the results of this survey for their reference.

REFERENCE OF FACILITY TYPES

CLASSROOM FACILITIES: (171 Series Category Code) Classroom and other special buildings in which instruction is given, or the design of which limits their use generally to instructional and training purposes. EXAMPLES: Battalion Classrooms, Flight Simulator Building, Covered Training Area, Applied Instructional Building, and Post Signal School.

RANGES & TRAINING GROUNDS: (179 Series Category Code) Training courses, ranges, maneuver areas, including training mockups, and similar type facilities provided for or limited in use to training. EXAMPLES: Field Firing Range, Impact Area, Hand to Hand Combat Pit, Confidence Course, and Parade and Drill Field.

MAINTENANCE FACILITIES: (210-218 Series Category Code) Facilities and shops in support of the maintenance repair operation function at military installations. EXAMPLES: Aircraft Component Maintenance Shops, Vehicle Maintenance Shop, Small Arms Repair Shop, Electronics and Electrical Maintenance Shop, Vehicle Wash Shop.

MEDICAL FACILITIES: (500 Series Category Code) Facilities providing for both in patient and out patient medical care. EXAMPLES: Hospital, Dental Clinic, Medical Laboratory, Morgue, Clinic Without Beds.

ADMINISTRATIVE FACILITIES: (600 Series Category Code) Headquarters and office type buildings to accommodate offices, professional and technical activities, business machines, records, files, and administrative supplies for normal operation. EXAMPLES: Post Headquarters Building, Division Headquarters Building, Provost Marshal & Military Police Administration Building, Civilian Personnel Administration Building, Engineer Administration Building.

OPERATIONAL FACILITIES: (110-169 Series Category Code) All facilities for housing operations and operational types of activities and equipment. Also includes airfield pavements, and waterfront operational facilities. EXAMPLES: Buildings for radio, radar, relay, and telephone operations; Liquid Fueling & Dispensing Facilities, Communications Center, Weather Station, Reception Station Processing Facility, Company Headquarters Building.

STORAGE FACILITIES: (400 Series Category Code) Facilities for receipt of bulktype storage. EXAMPLES: Liquid Fuel Storage Facilities, Ammunition Storage Facilities, Cold Storage Warehouse, Family Housing General Storage, Aircraft Parts Storage Building.

UTILITY SYSTEMS: (800 Series Category Code) Central plants, systems, buildings and exterior lines for the processing, generation, distribution, and disposal of utility related resources. EXAMPLES: Power Plant Building, Electrical Power Transmission & Distribution Lines, Sewage & Industrial Waste Collection, Incinerator Building, Water Supply-Treatment-Storage, Roads and Streets, Fire & Other Alarm Systems, Telephone System.

M. W. R. FACILITIES: (740-750 Series Category Code) Athletic, recreational and resale facilities. EXAMPLES: Bowling Center, Cafeteria, Library, Commissary, Child Care Facilities, Bank, Baseball Field, Golf Course.

FAMILY HOUSING: (711-714 Series Category Code) Buildings to be used as family quarters with appurtenant facilities. EXAMPLES: Family Housing & Trailer Sites for Officer, NCO, Enlisted, and Civilian Personnel.

OTHER HOUSING: (720-725 Series Category Code) Public housing for unaccompanied personnel with appurtenant facilities. EXAMPLES: Barracks & Dormitories for Unaccompanied Offices and Enlisted Personnel, Unaccompanied Personnel Housing Dining Facilities, Troop Housing Emergency.

R & D FACILITIES: (300 Series Category Code) Buildings used directly in theoretical or applied research, development, and testing, operations related to basic research. EXAMPLES: R & D Science Laboratories, R & D Aircraft & Flight Equipment Facility, R & D Weapons & Weapon Systems Facility, R & D Communications Equipment Facility.

REFERENCE OF FACILITY CHARACTERISTICS

QUANTITY/ AMOUNT: The gross square feet of a particular facility type, or the total land area of an installation's ranges and training grounds.

FUNCTIONAL ADEQUACY: On average, how well a facility type addresses the needs of its users.

PHYSICAL CONDITION: On average, the state of repair of a particular facility type.

MANAGEABILITY: On average, the level of expenditures required to maintain a particular facility type at acceptable standards over time.

FLEXIBILITY: On average, how well a particular facility type can adapt to changing requirements over time.

APPEARANCE: On average, the aesthetic quality of a particular facility type.

LOCATION/ PROXIMITY: On average, the geographic relationship of a particular facility type to other installation facilities.

Appendix D: Results of Commanders' Survey

SURVEY OF INSTALLATION COMMANDERS:
IDENTIFYING THE RELATIONSHIP BETWEEN COMMANDER OBJECTIVES AND FACILITY CHARACTERISTICS

Study by

Facility Systems Division
US Army Construction Engineering Research Laboratories
and
Department of Architecture
Massachusetts Institute of Technology

Report by

Steven L. Duckworth
Ph.D. Candidate in Building Economics
Massachusetts Institute of Technology

July 15, 1992

1. Introduction

The Army has significant real property holdings to support its overall strategic objectives or mission. At the installation level, the mission is broken down into installation specific objectives by each residing commander. The purpose of this study was to identify the fundamental relationships between these objectives (e.g., readiness, quality of life, soldier retention) and real property characteristics (e.g., facility type, quantity/amount, physical condition) from the key perspective of the commander. That is, installation commanders were asked to identify the real property characteristics that are most important in achieving each of their top strategic objectives. These relationships are critical in defining a common language that can facilitate communication between commanders and the Directorate of Engineering and Housing (DEH). A decision support system that is based on a framework of these relationships can provide both levels of management a means to assess the potential impact of real property decisions on the achievement of strategic objectives, and vice versa. Having such capability will translate into more informed capital resource allocation decisions and, ultimately, an incremental improvement in the performance of the overall installation.

2. Background

For the past several years, researchers at the US Army Construction Engineering Research Laboratories (USACERL) and the Massachusetts Institute of Technology (MIT) have been investigating issues concerned with the management of real property at the disposal of large public and private organizations that are not primarily in the real estate business. A key element in this work is understanding how the characteristics of an organization's real property can be kept in-line with the changing objectives of its top-level management. This study is instrumental in further understanding that relationship in terms of Army facilities and commander objectives, respectively.

In the initial stage of this project, a literature search was conducted of various published and unpublished studies relating to this topic. Two governmental reports were found to be highly relevant: (1) the *DEH Role in Readiness/Warfighting* prepared by the Program Analysis and Evaluation Office of the US Army Engineering and Housing Support Center, and (2) the *Military Compensation X Factors* prepared by the Defense Technical Information Center of the Defense Logistics Agency. Although these studies explored the relationship between certain possible commander objectives and facility characteristics, they did not focus on that relationship from the key perspective of the commander.

In order to more fully understand the decision processes associated with the operation, maintenance, repair, renovation, and new construction of installation facilities, the USACERL and MIT project teams visited two representative installations: (1) Ft. Leonard Wood (TRADOC), and (2) Ft. Polk (FORSCOM) (refer to section 2.1 for date of visits). Interviews were conducted with the Director and Deputy Director of Engineering and Housing, Chief of Engineering and Resource Management, and Chief and Master Planner of Engineering Plans and Services. These interviews laid the groundwork for further survey development.

To ensure that the survey was viable, interviews were conducted with the following commanders: (1) MG Van Loben Sels of Ft. Monroe (past commander of Ft. Leonard Wood), (2) LTG Wishart of Ft. Leavenworth, (3) MG Schroeder of Ft. Leonard Wood, and (4) LTG Stiner of Ft. Bragg (refer to section 2.1 for date of visits). Each commander completed an actual questionnaire and made both written and oral comments to the USACERL and MIT team members present. A forty-five minute interview was conducted to discuss the premise of the survey. In each case, the survey was approved.

2.1 Key Events in Survey Development

10/06/88	Meeting at MIT	USACERL principal investigator meets with MIT project team.
10/27/88	Meeting at MIT	USACERL and MIT project teams meet to plan research.
01/18/89	Site Visit	USACERL principal investigator and MIT project team visit Ft. Leonard Wood (TRADOC), various DEH personnel interviewed.
02/09/89	Site Visit	USACERL principal investigator and MIT project team visit Ft. Polk (FORSCOM), various DEH personnel interviewed.
03/10/89	Meeting at MIT	USACERL and MIT project teams determine research schedule and discuss questionnaire.
03/23/89	Meeting at USACERL	USACERL and MIT project teams review research design and prototype questionnaire.
04/18/89	Submittal of first draft	MIT submits first draft of questionnaire for USACERL review.

05/01/89	Review/Meeting	MIT project team reviews USACERL comments on first draft of questionnaire.
05/11/89	Submittal of second draft	MIT submits second draft of questionnaire for USACERL review.
05/25/89	Submittal of revision	MIT submits revised second draft of questionnaire for field pre-testing.
09/07/89	Pre-test site visit to Ft. Monroe	USACERL principal investigator and MIT team member interview MG Van Loben Sels concerning prototype questionnaire.
09/14/89	Pre-test site visit to Ft. Leavenworth	USACERL principal investigator interviews LTG Wishart concerning prototype questionnaire.
09/21/89	Pre-test site visit to Ft. Leonard Wood	USACERL principal investigator interviews MG Schroeder concerning prototype questionnaire.
10/12/89	Meeting at MIT	USACERL and MIT project teams meet to discuss results of pre-test site visits and schedule.
10/24/89	Pre-test site visit to Ft. Bragg	USACERL principal investigator interviews LTG Stiner concerning prototype questionnaire.
	— Project put on hold for one year due to a lack of funding —	
08/30/90	Meeting at MIT	USACERL and MIT project teams meet to discuss final revisions to questionnaire, survey justification and administration plans.
09/12/90	Submittal of final draft & survey justification	MIT submits final draft of questionnaire for approval through official channels, submits survey justification statement to USACERL.
10/90	Submittal of letter for survey approval	USACERL seeks survey approval through Mr. Greg Brewer.

01/16/91	Survey approved	USACERL receives approval for survey from MG Peter J. Offringa.
02/91	Request for MACOM participation	USACERL sends letters to MACOMs requesting their support and identification of participating installations.
03/91-05/91	MACOMs identify participants	USACERL receives lists of participating installations.
07/15/91	Submittal of questionnaires for distribution	MIT submits required number of questionnaires to USACERL for distribution.
07/24/91	Questionnaires mailed	USACERL mails questionnaires to participating installations.
10/91	Questionnaires remailed	Due to lack of response, USACERL remails questionnaires to TRADOC and FORSCOM installations.
11/15/91	MIT receives completed questionnaires	USACERL forwards completed questionnaires to MIT for analysis.
02/05/92	Meeting at USACERL	MIT presents preliminary analysis of survey results to USACERL project team.
07/15/92	MIT submits final report	MIT submits final project report.

3. Questionnaire Overview

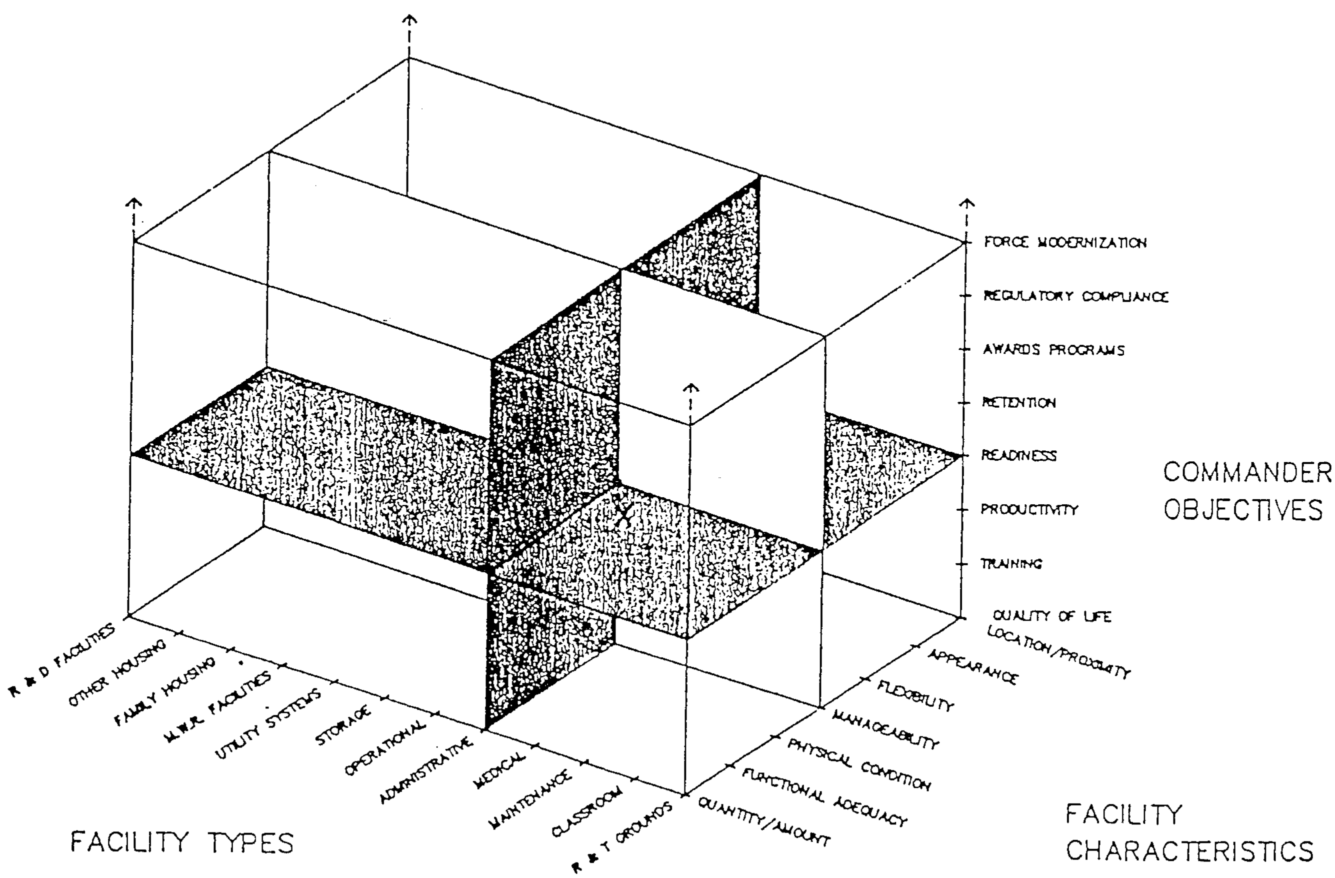
The questionnaire was organized into three core sections. The first section included three questions. In question one, commanders were asked to rate the importance of eight "common" objectives on a scale from one to five, less to more important respectively. While commanders were not expected to entirely agree upon the terminology or scope of these objectives as applied to their respective installations (that is why space was provided to fill in additional objectives), each objective was stated in terms that were understandable and somewhat relevant to each commander's situation (all stated objectives were based on installation specific documents and Army reports).

In question two, commanders were asked to rate on a scale from one to five the importance of five types of means (resources) in achieving their overall objectives. Objectives were referred to in aggregate form and facilities were introduced in the context of other comparable means available to commanders. The purpose was to identify the relative importance of facilities among other comparable means in achieving a commander's overall objectives.

In question three, commanders were asked to rate on a scale from one to five the importance of various organizational elements in achieving their overall objectives. Objectives were again referred to in aggregate form and all organizational elements listed were at the directorate level (or comparable) and above. The purpose was to identify the relative importance of the DEH among other comparable organizational elements in achieving a commander's overall objectives.

The second core section consisted of a series of three matrix questions. They were designed to address the project's primary objective of identifying the fundamental relationships between facilities and commander objectives from the key perspective of the commander. Each question had three variables: (1) facility characteristics, (2) facility types, and (3) commander objectives, as represented in Figure 1 by axes X, Y, and Z, respectively. The lists of facility characteristics (X) and facility types (y) strive

Figure 1. Structure of Matrix Questions



(EXAMPLE)
FIRST OBJECTIVE

READINESS

FACILITY CHARACTERISTICS

	Quantity/ Amount	Functional Adequacy	Physical Condition	Manage-ability	Flexibility
Ranges & Training Grounds	2	1			3
Classroom Facilities	1	3	2		
Maintenance Facilities					
Medical Facilities					
Administrative Facilities		3	1	2	

Figure 2. Sample Matrix Question

to be mutually exclusive and collectively exhaustive in representing typical installation facility stocks. Since commanders were given the opportunity to specify objectives in their own terminology in each question, the list of commander objectives was relatively open-ended as indicated by axis Z. Together these axes define the area within which relationships between variables could be identified by commanders. For example, point "X" represents the intersection or relationship between the objective of "readiness" (red plane), the facility type of "administrative" (blue plane), and the facility characteristic of "manageability" (yellow plane). Such a relationship is indicated by the number "2" under "manageability" in the example matrix question in Figure 2. Twelve such relationships were identified for each objective.

A series of opinion statements constituted the third core section. These statements covered more dynamic, policy oriented issues and were used to "fill in the gaps" or supplement material covered in the previous questions. Commanders were asked to rate how strongly they disagreed or agreed with very specific statements on a scale from one to five, respectively. Commanders attitudes toward these statements were compared from installation to installation.

4. Research Methodology

When evaluating the results of this survey it is important to consider several points. First, the results presented in the following section reflect only the answers reported by the commanders themselves and not necessarily the true state of reality. As such, the answers provided indicate management attitudes and do not necessarily correspond to actual management behavior. Since time-series data on capital expenditures are available at the installation level, exploring the relationship between management attitudes and behavior is feasible and would be an interesting extension to this study.

Second, the completely random character of the sample cannot be assured. Upon approval of the survey, USACERL requested the MACOMs to "[...] compile a list of installations in your command that you think would be most responsive to the questions in the survey." Although this approach was necessary and virtually unavoidable due to protocol, the actual criteria by which the installations were chosen to participate are unknown and therefore a certain amount of bias can be suspected in the sampling scheme. For example, an analysis of the facilities square footage and operating cost of installations in the population and sample indicates some bias toward larger installations. More specifically, the average facilities square footage of installations in the population and sample is 6,314,000 and 9,148,000 respectively, and the average operating cost is $27,309,853 and $38,810,058 respectively (the standard deviation for these two variables did not vary appreciably between the population and sample). Although this disparity may limit inferencing about the population to larger installations, it is likely that such a focus will better elucidate the relationship between commander objectives and facility characteristics.

Finally, sampling bias notwithstanding, the survey sample is relatively well-rounded in terms of MACOMs. As summarized in Table 1, virtually all of the Army MACOMs are represented in the sample and the average response rate for those MACOMs that did participate in the study exceeded 61%. The sample is also reasonably well distributed across commander rank. Table 2 shows that about three-fourths of the respondents were Colonels, but this seems to be representative of the population.

Table 1. Survey Response by MACOM

MACOM	SURVEYS MAILED	USABLE RETURNS	RESPONSE RATE
AMC	8	7	88%
FORSCOM	20	11	55%
TRADOC	6	4	67%
US Army Pacific	3	2	67%
US Army Korea (8th)	6	2	33%
US Army Europe (7th)	28	9	32%
USARSO	4	2	50%
US Army Intelligence & Security	1	0	0%
US Army Information Systems	1	1	100%
TOTAL	77	38	49%

Table 2. Survey Response by Commander Rank

COMMANDER RANK	USABLE RETURNS	PERCENT OF TOTAL
Major/GS-13	2	5%
Lt. Colonel/GS-14	1	3%
Colonel/GS-15	29	76%
Brig. General	1	3%
Maj. General	5	13%
TOTAL	38	100%

5. Survey Results

5.1. The Importance of Various Objectives, Means, and Organizational Elements

Despite the diversity among installations and their missions, there is considerable agreement among commanders regarding the importance of certain objectives and the means and organizational elements most needed to accomplish them. As shown in Figure 3, approximately three-quarters of the commanders responding to the survey reported that quality of life is an objective of primary importance, with an average rating of 4.74. This consensus is indicative of the strong relationship between the personal well-being and professional performance of soldiers. Readiness, training, productivity, and statutory compliance are the next most widely recognized objectives of primary importance, with roughly one-half of the commanders giving them a rating of 5, an average of greater than 4 in each case. This reflects the fact that readiness and training are perhaps the two most common objectives in the Army, while productivity and statutory compliance indicate key future concerns. Over 85% of the commanders gave retention and awards programs a rating of either 3 or 4, a clear indication that these objectives are of secondary importance. Thus, there are distinct patterns of importance among commander objectives.

Likewise, there are certain means and organizational elements that are more important than others in achieving commander objectives. As shown in Figure 4, commanders overwhelmingly agree (92%) that funding is a resource of primary importance. This is not surprising in light of the current downsizing initiative in the Army, as well as the depressed economic environment in general. With the exception of funding, however, no other resource is more widely regarded of primary importance

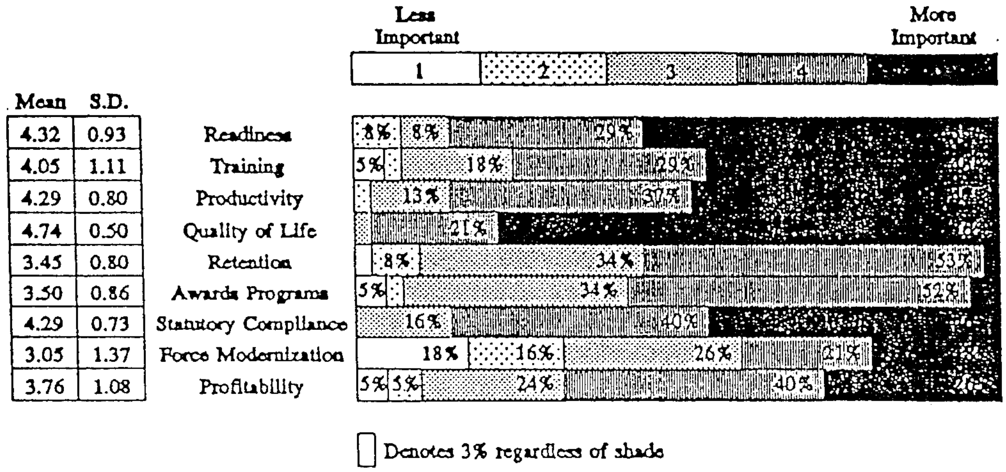
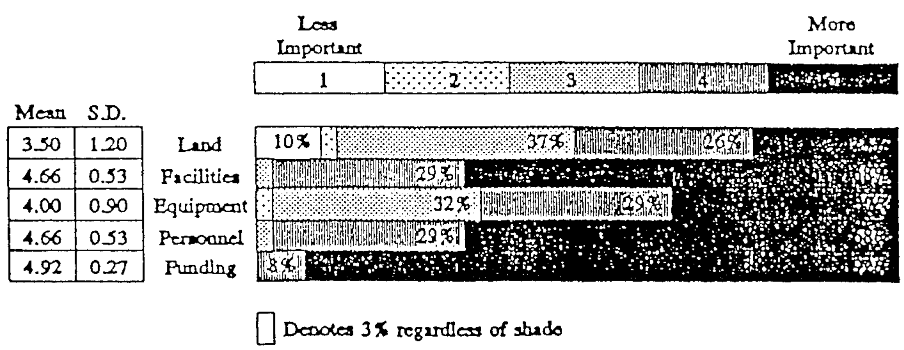


Figure 3. Importance of Various Commander Objectives

by commanders as facilities. Interestingly, facilities and personnel received identical responses in each category of importance. This equality is far less evident in industry. For example, corporate real estate is rarely managed at the executive committee level with human and monetary resources. Equipment and land are resources of secondary importance, with an average rating of 4 and 3.5 respectively.

In order to effectively and efficiently utilize available resources and thereby achieve a given set of objectives, commanders must rely on the expertise of various organizational elements. As shown in Figure 5, at least one-half of the commanders reported that the Directorates of Engineering and Housing (68%), Resource Management (63%), Personnel and Community Activities (58%), and Logistics (50%) are organizational elements of primary importance, each with an average rating of about 4.5. These responses are consistent with the key objectives and means previously discussed. For example, just as the commanders reported that facilities is a key resource in

Figure 4. Importance of Various Means in Achieving Commander Objectives



Mean	S.D.	
3.47	1.16	Headquarters Command
3.76	1.20	Major Subordinate Commanders
4.58	0.60	Resource Management
4.58	0.79	Engineering & Housing
4.42	0.86	Personnel & Community Activities
4.13	0.84	Plans, Training & Mobilization
3.55	0.98	Security
4.48	0.60	Logistics
3.74	0.72	Provost Marshal's Office
3.66	0.85	Information Management
2.82	1.25	Reserve Component Support
4.08	1.08	Contracting

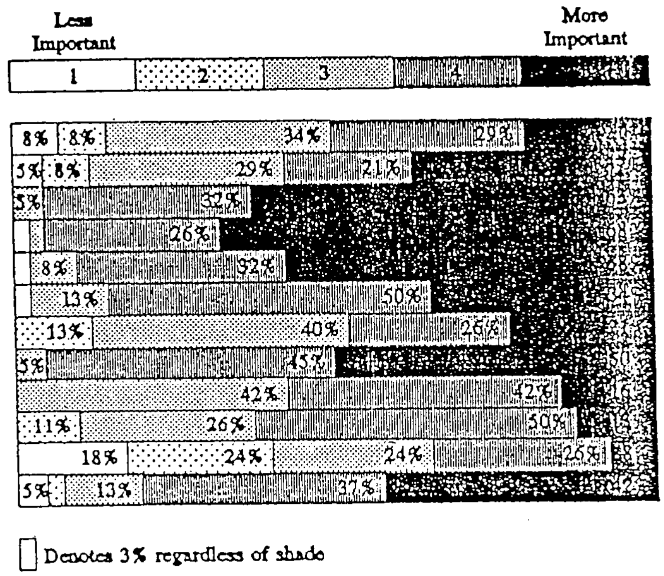


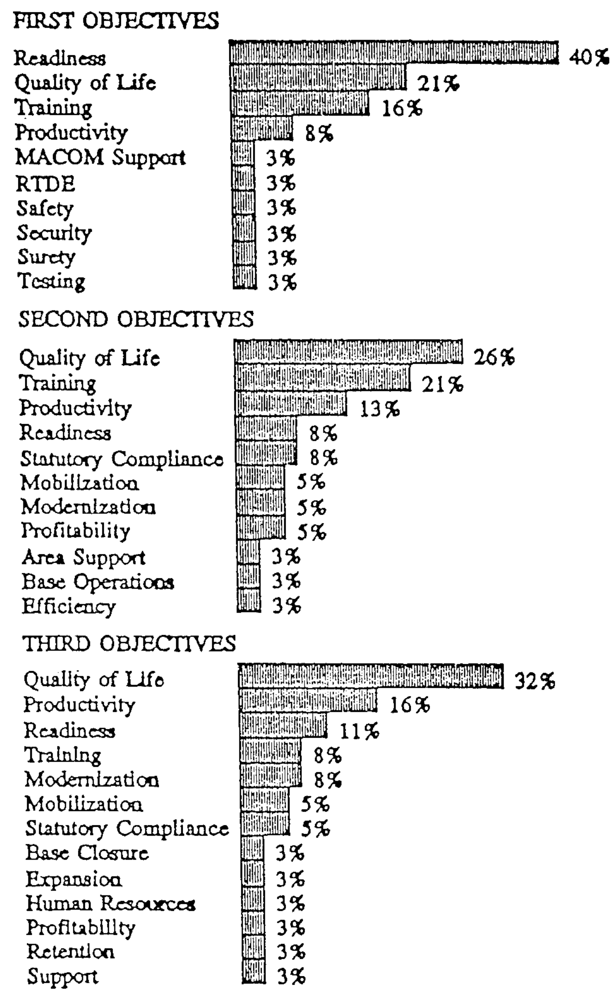
Figure 5. Importance of Various Organizational Elements in Achieving Commander Objectives

achieving their objectives, they also reported that the DEH, the organizational element responsible for managing that resource, is of primary importance. Two organizational elements that are viewed as slightly less important are the Directorates of Plans, Training and Mobilization, and Contracting, with about 80% of the commanders giving them a rating of either 4 or 5, an average rating of 4.13 and 4.08 respectively. Of secondary importance are the Provost Marshal's Office and Directorate of Information Management, receiving a rating of either 3 or 4 by 84% and 76% of the commanders respectively. Finally, there is less consensus among commanders regarding the importance of the Headquarters Command, Major Subordinate Commanders, and Reserve Component Support, each having a standard deviation well over 1. This spread may be due to the fact commanders are uneasy about rating the importance of their own directorate, and it is possible that the Major Subordinate Commanders and Reserve Component Support were not adequately defined in the questionnaire and/or less applicable across installations.

5.2 The Relationship Between Commander Objectives and Facility Characteristics

When the commanders were given an opportunity to use their own terminology in specifying their first, second, and third most important objectives, their responses remained relatively uniform. Of 114 possible responses (38 commanders specifying three objectives each), only 22 different objectives were reported, some of which may merely represent semantic differentiations (e.g., MACOM Support, Area Support, Support). As shown in Figure 6, four of these objectives are prominent: (1) readiness, (2) quality of

Figure 6. First, Second, and Third Most Important Commander Objectives



life, (3) training, and (4) productivity (note that their importance is also reflected in Figure 3). Interestingly, 40% of the commanders reported that readiness is their most important objective, while relatively few specified it as their second (8%) or third (11%) objective. This reflects how fundamental readiness is to the mission of the Army. In contrast, quality of life received a relatively consistent response across the three levels of importance. Although the commanders cited it as their most important objective only half as often as readiness (21% verses 40% respectively), it represents the most frequently cited second (26%) and third (32%) objective.

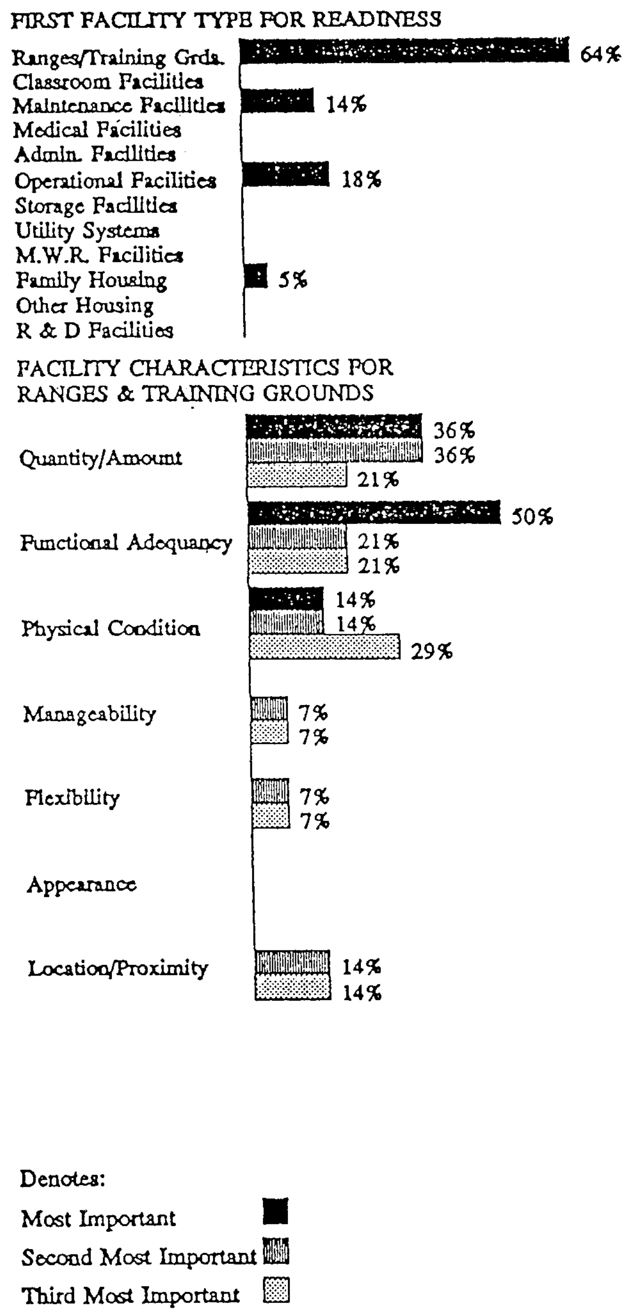
Training and productivity are among the few objectives of highest priority to commanders, but they appear to be slightly less prominent than readiness and quality of life. Training tends to be regarded as more of a first (16%) or second (21%) objective than a third (8%) objective. Conversely, the commanders seem to rank productivity as a second (13%) or third (16%) objective more often than a first (8%) objective.

Thus, even within this group of four critical objectives, it appears that readiness is the most important, followed closely by quality of life, then training and productivity. Based on this ranking, the first, second, and third most important facility types and characteristics for readiness and quality of life will be examined in detail in sections 5.21 through 5.26.

5.21 Most Important Facility Type for Readiness

As shown in Figure 7, of those commanders with readiness as one of their top three objectives, 64% reported that ranges and training grounds is the most important facility type in achieving readiness at their installation, eclipsing all other facility types by at least threefold. Of that 64%, approximately half regarded the functional adequacy of ranges and training grounds as the most important facility characteristic. The quantity/amount (36%) and physical condition (29%) of ranges and training grounds are the most frequently cited second and third facility characteristics, respectively.

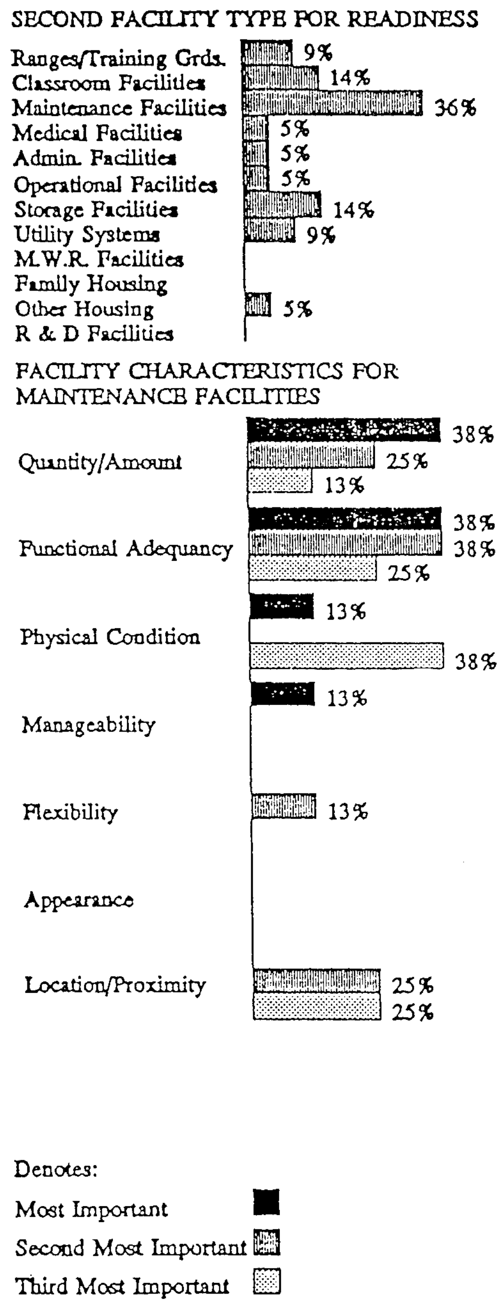
Figure 7. Readiness: First Facility Type and its First, Second, and Third Facility Characteristics



5.22 Second Most Important Facility Type for Readiness

As shown in Figure 8, of those commanders with readiness as one of their top three objectives, 36% reported that maintenance facilities is the second most important facility type in achieving readiness at their installation, over twice the percentage of all other facility types. Of that 36%, roughly 38% indicated that quantity/amount and functional adequacy are the two most important characteristics of maintenance facilities. Similarly, 38% reported that functional adequacy and physical condition are respectively the second and third most important characteristics of maintenance facilities.

Figure 8. Readiness: Second Facility Type and its First, Second, and Third Facility Characteristics

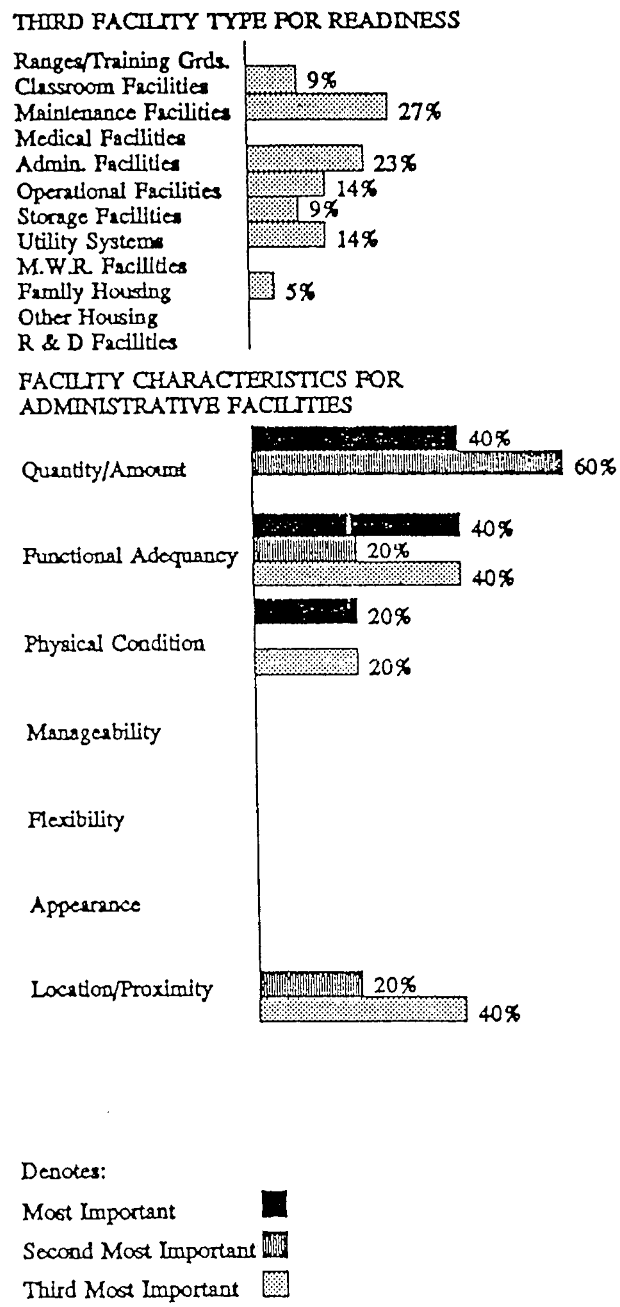


5.23 Third Most Important Facility Type for Readiness

As shown in figure 9, of those commanders with readiness as one of their top three objectives, 27% reported that maintenance facilities is the third most important facility type in achieving readiness at their installation. Administrative facilities, however, are close behind at 23%. Notice that there is less consensus among commanders as the level of facility importance decreases. That is, fewer facility types are generally cited, and a greater standard deviation is observed when commanders are asked to identify the most important facility type in achieving a particular objective than when asked to identify the second or third most important facility type in achieving that objective.

Since the important characteristics of maintenance facilities were discussed in the previous section, those for administrative facilities will be examined here. Of the 23% of the commanders who reported that administrative facilities is the third most important facility type in achieving readiness, about 40% regarded the quantity/amount and functional adequacy of those facilities as the two most important characteristics (see Figure 9). Quantity/amount (60%) was also identified as the second most important facility characteristic, while functional adequacy and location/proximity tied for third most important at 40%.

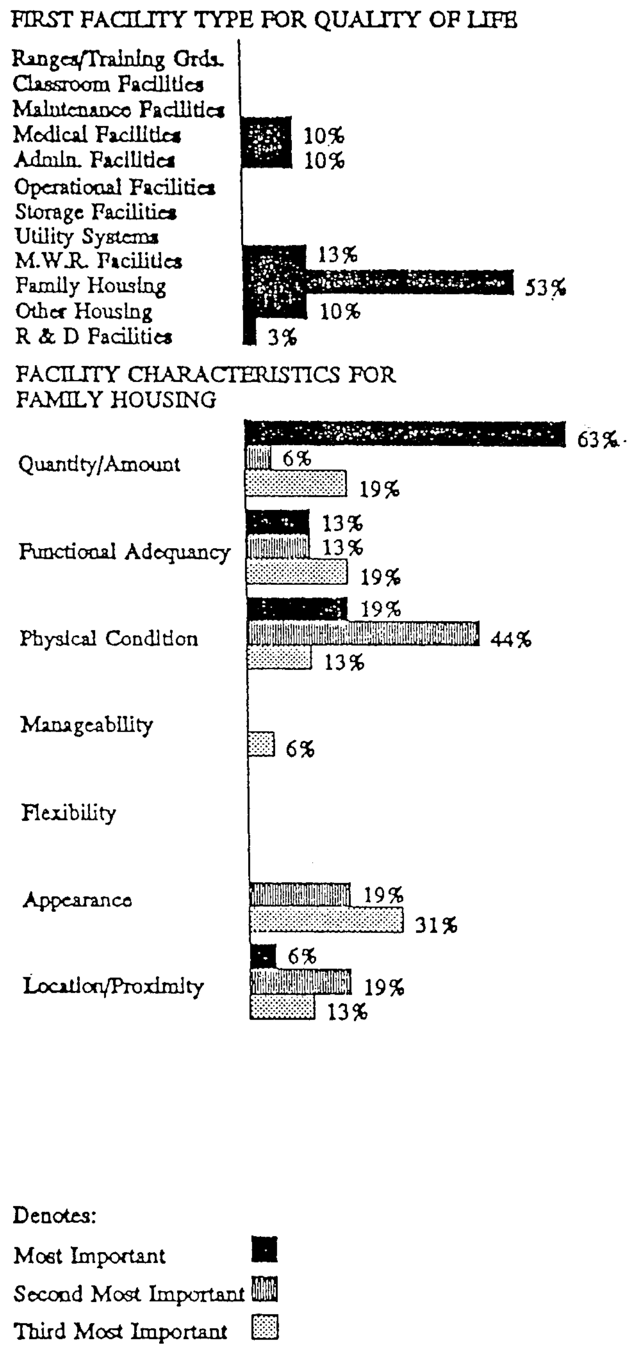
Figure 9. Readiness: Third Facility Type and its First, Second, and Third Facility Characteristics



5.24 Most Important Facility Type for Quality of Life

As shown in Figure 10, of those commanders with quality of life as one of their top three objectives, 53% reported that family housing is the most important facility type in achieving quality of life at their installation, at least four times more frequently cited than all other facility types. Of that 53%, almost two-thirds indicated that it is most important to provide an adequate quantity/amount of family housing. The physical condition (44%) of family housing is the second most important characteristic, while appearance (31%) is of third importance.

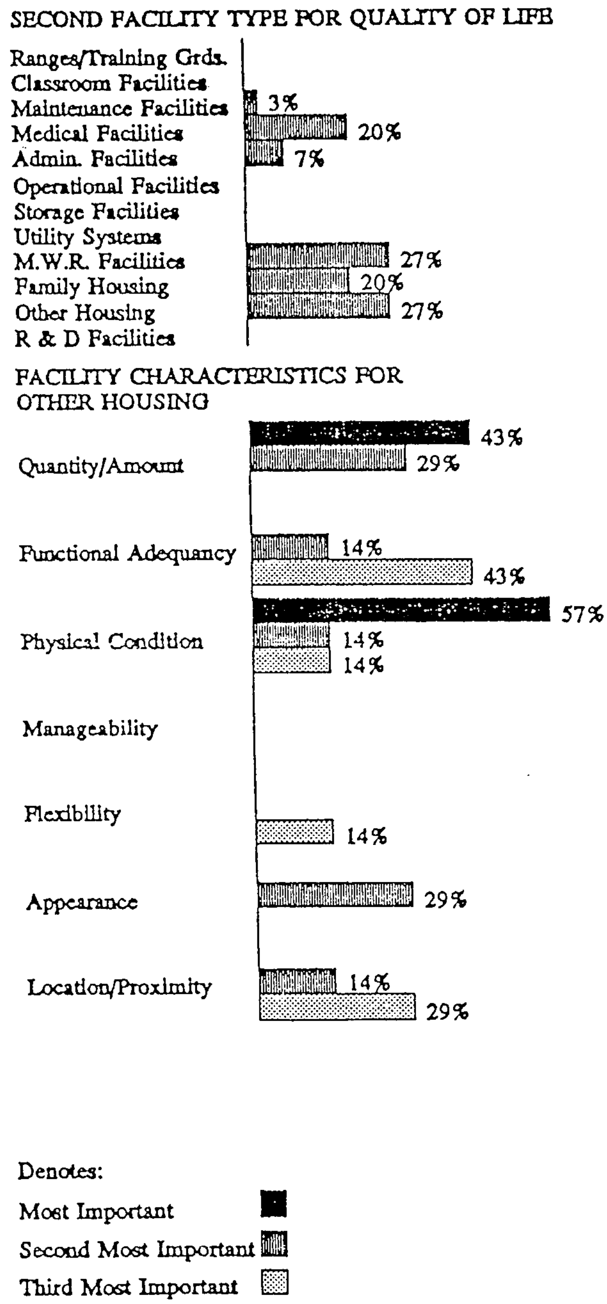
Figure 10. Quality of Life: First Facility Type and its First, Second, and Third Facility Characteristics



5.25 Second Most Important Facility Type for Quality of Life

As shown in Figure 11, of those commanders with quality of life as one of their top three objectives, 27% reported that other housing (e.g., barracks and dormitories for unaccompanied officers and enlisted personnel) and M.W.R. facilities are the two most important facility types in achieving quality of life at their installation, followed closely by medical facilities and family housing at 20%. The most important characteristics of other housing will be discussed in this section, as those of M.W.R. facilities will be reviewed in section 5.26. Of those commanders reporting that other housing is the most important facility type in achieving quality of life, 57% regarded the physical condition of that housing as most important. The quantity/amount (29%) and functional adequacy (43%) of other housing are the most frequently cited second and third facility characteristics, respectively.

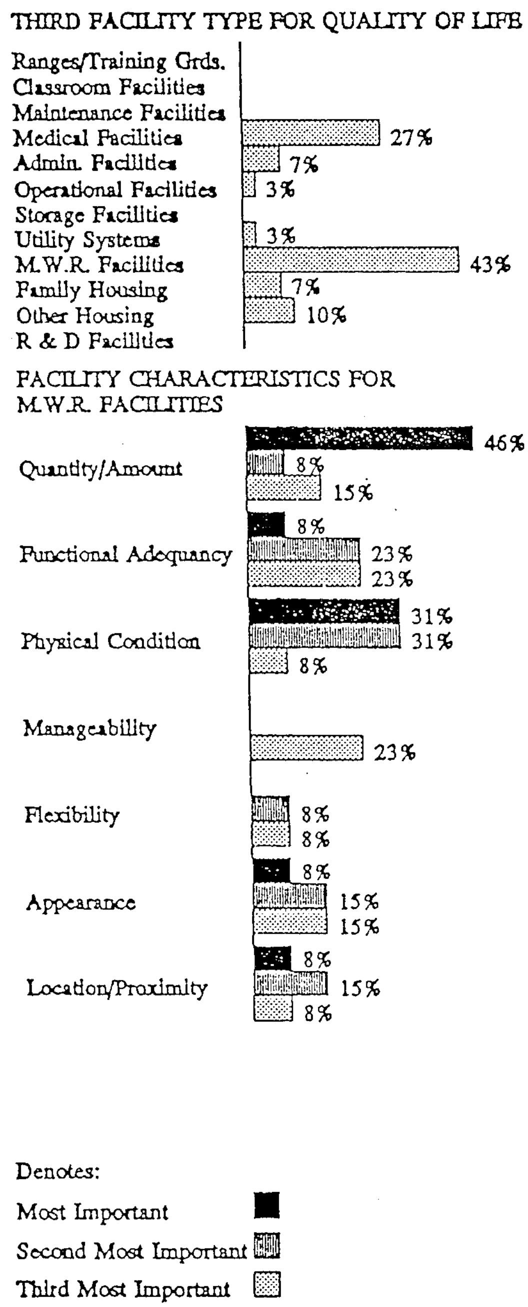
Figure 11. Quality of Life: Second Facility Type and its First, Second, and Third Facility Characteristics



5.26 Third Most Important Facility Type for Quality of Life

As shown in Figure 12, of those commanders with quality of life as one of their top three objectives, 43% reported that M.W.R. facilities is the third most important facility type in achieving quality of life at their installation. Of that 43%, almost half indicated that it is most important to provide an adequate quantity/amount of M.W.R. facilities, and nearly one-third regarded the physical condition of those facilities as the second most important characteristic with which to be concerned. Functional adequacy and manageability tied at 40% for the third most important characteristic of M.W.R. facilities.

Figure 12. Quality of Life: Third Facility Type and its First, Second, and Third Facility Characteristics



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